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USSR Report

ELECTRONICS AND ELECTRICAL ENGINEERING

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ELECTRONICS AND ELECTRICAL ENGINEERING

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This serial publication contains articles, abstracts of articles and news items from USSR scientific and technical journals on the specific subjects reflected in the table of contents.

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USSR

UDC 621.0.199

INVESTIGATION OF ANTENNAS WITH DISPLACED FOCAL AXIS AND HYPERBOLIC SUBREFLECTOR

Moscow RADIOTEKHNIKA in Russian Vol 34, No 5, May 79 pp 80-83 manuscript received after completion, 20 Sep 78

YERUKHIMOVICH, YU. A., MIROSHNICHENKO, A. YA. and KULIKOV, YE. S.

[Abstract] Comparative experimental studies are done on antennas with a subreflector: Cassegrain, and parabolic with displaced focal axis and elliptic and hyperbolic subreflectors. The three different types of antennas had the same diameter and aperture angle of the main dish, and identical primary radiators. The results show that parabolic antennas with displaced focal axis and hyperbolic subreflector can be made with a utilization factor of 0.7 or more and improved matching of antenna input to the feeder waveguide. This arrangement can also be used for partial optimization of a Cassegrain antenna by using the appropriately calculated subreflector. The antenna with displaced focal axis and hyperbolic subreflector is intermediate in its characteristics between the ordinary Cassegrain and an optimized antenna. These antennas can be used both for radio relay work and for communications in outer space. Figures 2; references 11: 6 Russian, 5 Western.

USSR

UDC 621.396.6

INTRODUCTION TO THE THEORY OF ADAPTIVE ANTENNAS. THE STEADY STATE

Moscow RADIOTEKHNIKA in Russian Vol 34, No 5, May 79 pp 7-16 manuscript received 4 Dec 78

PISTOL'KORS, A. A. and LITVINOV, O. S.

[Abstract] This is the first in a series of papers dealing with the use of adaptive antennas for suppressing radio reception interference caused by noise signals arriving from directions that are unknown beforehand. The purpose of these articles is to acquaint antenna specialists with calculation of the new type of antennas and with aspects of the theory such as signal-to-noise ratio, parasitic noises of adapting circuits, and the dynamics of the adaptation process, as well as practical possibilities for satisfying requirements. The initial arrangements on which adaptive antennas are based can be treated as phased arrays. The signals received by each dipole pass through an amplifier and a phase shifter, and are then added with appropriate weighting factors. The problem of calculation is to select weights that optimize reception from a given direction in the

sense of suppressing interference in the final steady state. The reader is expected to have a knowledge of the elements of the theory of random processes and the fundamentals of matrix algebra. Figures 1; references: 2 Russian.

USSR

UDC 621.396.67

USING NEAR-FIELD HOLOGRAMS TO MEASURE THE RADIATION PATTERN OF ANTENNAS WITH PROCESSING IN INCOHERENT LIGHT

Gor'kiy IZV:VUZ: RADIOFIZIKA in Russian Vol 22, No 5, 1979 pp 641-643 manuscript received 6 Jun 78

BELOV, YU. I., ZUYKOVA, I. M., PIGULEVSKIY, YE. D. and RYZHKOV, A. P., Scientific-Research Institute of Radio Physics

[Abstract] The paper gives the results of processing of hologram transparencies recorded on a plane for a two-dimensional acoustic antenna array, and also on a sphere for a 7-meter parabolic microwave dish. The hologram recorded on the plane was processed by an analog spectrum analyzer using incoherent light. Processing of microwave holograms in incoherent light not only reconstructed the radiation pattern, but enabled experimental determination of the error directly associated with recording and processing of the hologram. A comparison of the experimental results of optical processing with corresponding data of computer processing of antenna measurements shows that a number of problems in near-field analysis of antenna radiation patterns could be solved by developing precision optoelectronic analog devices using incoherent light. Figures 3; references: 7 Russian.

USSR

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IMPROVED ADAPTATION ALGORITHMS OF PHASED ANTENNA ARRAYS

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 5, 1979 pp 35-43 manuscript received 4 Jul 77; after revision, 1 Aug 78

SAMOYLENKO, V. I., ZAROSHCHINSKIY, O. I. and GRUBRIN, L. V.

[Abstract] The use of adaptive phased antenna arrays (FAR) in radar, communication and other fields of radio engineering has significantly increased the signal-to-noise ratio at the output of an antenna system as compared

with ordinary methods using special amplitude distributions. There are several groups of algorithms for adapting FAR: criterion of maximum signal-to-noise ratio, criterion of least rms error, algorithms of optimization with constraints, etc. Problems encountered in practical application of algorithms are associated with the slow rate of convergence of algorithms and the substantial loss of total gain of an adaptive FAR against a high level of spatial white noise. The presence of a sufficiently powerful useful signal leads to deterioration of characteristics of an adaptive FAR unless ancillary steps are taken in order to support the primary lobe of the beam pattern. Methods are examined for acceleration of the rate of convergence of adaptive FAR algorithms based on evaluation of the field of localization of inherent values of the noise correlation matrix. Nonlinear constraints on weights in order to support the desired level of the beam pattern in the anticipated direction of arrival of useful signal are examined. Figures 5; references 14: 6 Russian, 8 Western.

USSR

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EXACT AND APPROXIMATE METHODS OF CALCULATION OF LOG PERIODIC DIPOLE ANTENNAS

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 5, 1979 pp 69-72
manuscript received 7 Aug 78

YATSKEVICH, V. A. and LAPITSKIY, V. M.

[Abstract] The numerical method of analysis of a log periodic dipole antenna (LPVA) was first proposed by Carroll: the antenna was represented as a parallel connection of two multipoles, one of which describes a system of parallel dipoles and is characterized by a matrix of mutual impedances, while the second describes a distributive feeder with a matrix of conductivities. Strict calculation of a LPVA using a three term approximation of current in a Hallen system of integral equations yields values for directive gain (KND) and are 1-2 dB lower than that derived by Carroll: this implied the unacceptability of the method of directed electrodynamic forces for analysis of LPVAs. The divergence of results, however, occurs because the beam pattern had been calculated with an error: with the correct computation of directive gain, the difference between the strict and approximate values virtually disappears. A new method was developed for strict description of LPVA using a Pocklington system of integral equations combined with the Galerkin method; as the basis was selected the piecewise-sine function system proposed by Richmond. For log periodic antennas with a frequency band greater than one octave, the method of directed electrodynamic forces can be utilized only if the dipoles of the active region play the leading role in antenna emission. For antennas where this condition is not met,

the use of the above method can lead to significant exaggeration of directive gain as compared with its true value. Figures 2; references 4: 2 Russian, 2 Western.

USSR

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CONCERNING TWO FORMULATIONS OF THE INDUCED E.M.F. METHOD

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79 pp 691-696 manuscript received 10 Apr 78

KONTOROVICH, M. I.

[Abstract] The induced e.m.f. procedure for calculating the input impedances of antennas has two close, but not equivalent formulations. In the case where the antenna current distribution function is real, both formulations yield the same result, but in other cases the input impedances computed by these two methods prove to be different. The present paper deals with this difficulty in detail and demonstrates that the less well-known formulation based on the reciprocity theorem and published by the author in 1951 is more precise. Similar formulas were derived in US literature in 1952, but without mentioning the induced e.m.f. method. The error analysis is illustrated by means of a very simple example where two complex impedances in parallel are driven by a current source. The analytical expressions derived from this for the error show the superiority of the less well-known procedure. References 3: 2 Russian, 1 Western.

USSR

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OPTIMIZATION OF REFLECTIVE PHASED ANTENNA ARRAY

Kiev IZV. VUZ: RADIOELEKTRONIKA in Russian No 5, 1979 pp 20-28 manuscript received 17 Jul 78

SAZONOV, D. M. and SHKOL'NIKOV, A. M.

[Abstract] Optimum parameters of a scanning reflective array with an isolating beam-pattern forming circuit (DOS) have been derived; the characteristics of this array are potentially possible for a reflective array with total compensation of emitter interrelationships. Scanning reflective arrays are usually constructed on the basis of a simple structure where the emitter loads are directly controlled reflecting phase inverters: these

systems were compared with the optimum theoretical versions. In the re-emitted field of a reflective array, there is a constituent which remains unchanged during scanning; the uncontrolled scattering field. With this form of array loading, the uncontrolled scattering field vanishes only if the emitters are matched and do not interact, or if the reflective array load is an isolating DOS. Approximate calculation of the states of phase inverters yields fully acceptable results if the phase values are corrected for optimum summation of controlled and uncontrolled portions of the field in the primary bearing. The lack of a correction factor may lead to losses in directive gain (KND) of the array up to 2 decibels and rises in the maximum level of side lobes (UBL) by 4-8 decibels. Figures 7; references: 5 Russian.

USSR

UDC 621.396.67:621.317.7

RESONANCE LENGTH OF HALF-WAVE MEASUREMENT ANTENNAS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 79 pp 50-51

ANTONOVA, T. N. and BUZINOV, V. S.

[Abstract] The resonant length of half-wave antennas used in field strength meters can be expressed as $2Z = \frac{\lambda}{2} (1 - 0.01\Delta)$, where Z is the half-length of the antenna tuned to resonance, λ is wavelength, and Δ is shortening of the antenna in percent. Analytical formulas for Δ are not sufficiently accurate when $\lambda/2a > 100$, where a is the radius of the wire used for the dipoles, and where the gap between dipoles is considerable. The thermal converter connected between dipoles on master antennas in reference field strength meters may introduce a considerable error in determining Δ by formulas. The authors propose an experimental method based on varying the load impedance, and determining the relation between input impedance and frequency in the resonance region. The experimental data were checked by measuring the same field strength with antennas of different diameters shortened in accordance with the experimental curve. Maximum discrepancy between readings was within 1 percent. Figures 1; references: 6 Russian.

ON THE POLARIZATION CHARACTERISTICS OF TWO-REFLECTOR ANTENNAS

Gor'kiy IZV.VUZ: RADIOFIZIKA in Russian Vol 22, No 5, 1979 pp 628-638

manuscript received 6 Dec 77

NARBUT, V. P.

[Abstract] An investigation is made of the polarization properties of two-reflector Cassegrain and Gregory antennas widely used in radioastronomy and systems of cosmic and satellite communication. The investigation is based on data on the current distribution on the main reflector. These antennas are compared with an axisymmetric parabolic dish by a method that is common to all types of reflector antennas. Limits are determined within which it is advisable to use an axisymmetric parabolic dish or a two-reflector antenna from the standpoint of cross polarization level. A critical analysis is made of information published in the literature based on the results of this work. It is shown that when two-reflector antennas utilize electric or magnetic dipoles and a Huygens element, the level of cross polarization is lower than for a parabolic dish. Some problems are discussed that relate to reduction of the cross polarization of two-reflector antennas by optimizing the radiators. Figures 5; references 15: 13 Russian, 2 Western.

USSR

UDC 62-52

AN ALGORITHM FOR DETERMINING STABILITY REGIONS IN PHOTOELECTRICAL CONTROL SYSTEMS

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian No 4, 1979 pp 25-29 manuscript received 19 May 78

GRIGOR'YEV, V. V., KOROV'YAKOV, A. N. and USHAKOV, A. V.

[Abstract] The problem of studying stability processes in a photoelectric tracking system (PESS) is reduced to analytic formation of an attraction region by whose characteristics the search algorithm parameter values are determined by the tracking object (OS) system. The attraction region of a dynamic system is that set of vector values of initial system states from which an asymptotic convergence of processes at the origin of the coordinates is ensured. The PESS actuator section is described by the equations $\dot{x} = Ax + Bu$, $y = Cx$. Theoretical computations can be illustrated by the example of analysis of processes of PESS capture of a phototachymetric profilometer. The characteristics of the capture region can be used to assign search algorithm parameters by the tracking object system. The search must be organized in such a manner that the values of system's coordinates (deflection, velocity, acceleration or linear combinations of these) at any instant of search satisfy the inequality $x^T Q x \leq \gamma$. This paper was recommended by the Department (Kafedra) of Automatics and Telemechanics, Leningrad Institute of Precision Mechanics and Optics. Figures 3; references 3: 2 Russian, 1 Western.

USSR

UDC 621.3.019.3

USE OF A HIGH SPEED MULTIDIMENSIONAL FOURIER TRANSFORM FOR POLYNOMIAL REPRESENTATION OF MULTIVALUED LOGIC FUNCTIONS

Moscow IZV. AKADEMI NAUK SSSR: TEKHNIЧЕСКАЯ КИБЕРНЕТИКА in Russian No 5, Sep/Oct 78 pp 202-205, manuscript received 12 Jan 76

LABUNETS, V. G. and SITNIKOV, O. P., Sverdlovsk

[Abstract] Results of harmonic analysis of groups are used to generate an algorithm for determination of the polynomial representation of functions in p-valued logic on the basis of truth tables. The algorithm is similar to the earlier Walsh fast Fourier transform algorithm. Machine time is reduced by the new algorithm by a factor of 3 to 16 in typical cases. References 7; 5 Russian, 1 Western, 1 Eastern European.

AN ALGORITHM FOR THE ANALYSIS OF COMPLEX SYSTEMS WITH DIFFERENT STEPS FOR SUBSYSTEMS

Moscow IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 6, Jun 79 pp 93-95
manuscript received 23 Oct 78

NORENKOV, I. P. and PIVOVAROVA, N. V.

[Abstract] A concentrated mathematical model of a composite object is equivalent to a system of ordinary differential equations, and the major component of the computer outlays is the expenditure of machine time, T_m , for its integration. An algorithm is proposed in which a reduction in T_m is achieved through the use of implicit methods of integration with unequal steps for the individual subsystems. The possibility of choosing individual steps for the subsystems is the major prerequisite for integration with optimum steps. A general composite object is described by a mathematical model in the form of a system of differential equations written in terms of the vectors of the determining coordinates (for example, nodal potentials), and their time derivatives. An analytical solution is obtained by the derivation of a system of finite equations and the use of Newton's method, which ultimately leads to an algorithm derived from a Jacobian matrix. An alternative approach to the integration of the proposed system of equations having different steps for subsystems would be a step-by-step organization of the calculations, i.e., a transition to a new time point after the convergence of the Newtonian iterations at the preceding point. It would be necessary to employ explicit predictive formulas for one of the variables in this case. The proposed variant differs in that the Newton iterations are organized in an external cyclical process, while the sorting of the time points is accomplished in an internal cyclical process. This rearrangement of the computational process is based on the introduction of implicit integration formulas, something which provides for computational stability and consequently, the possibility of substantially increasing the steps for the subsystems and curtailing T_m . The algorithm can prove to be efficient not only in analyzing system with physical components of different kinds, but also for the case of systems with components of the same kind, for example, LSI configurations when isolating subsystems in them having processes which run at substantially different rates. References: 2 Russian.

A SYSTEM FOR PROCESSING STATISTICAL DATA ON A DIGITAL COMPUTER

Minsk IZV. VUZ: ENERGETIKA in Russian No 4, Apr 79 pp 104-107 manuscript received 13 Jun 78

FARKHADZADE, E. M., candidate in technical sciences

[Abstract] A statistical data processing system is developed for analyzing materials on damage and repair of facilities in power systems. The input includes operational data, and also the results of full-scale and laboratory tests of machines and equipment used in the system. The proposed system incorporates techniques for small-sample statistical processing and methods of checking the accuracy of reliability characteristics. The main program divides data into groups according to specific features. Sub-programs handle classification of the equipment used, classification of cases of equipment failure, calculation of patterns of variation in equipment damage with time, calculation of the change in probability of a given event, calculation of an estimate of the mathematical expectation of a random quantity, calculation of the statistics of a random quantity, and determination of the configuration of the distribution function of random quantities. A flowchart is given, and some particulars of the system are briefly discussed. The paper was submitted by the Department (Kafedra) of Electrical Stations, Azerbaydzhan Institute of Petroleum and Chemistry imeni M. Azizbekov.

METHOD OF STRUCTURAL ENGINEERING SYNTHESIS OF ELECTRONIC CIRCUITS

Moscow IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 6, Jun 79 pp 7-13 manuscript received 18 Jan 79

GLORIOZOV, YE. L.

[Abstract] The structural synthesis of electronic logic circuits can be formulated in the terms of a state space. The sequence in which the states are considered and the order for the application of the operators is controlled by the properties of the states already considered prior to this step through the introduction of a so-called estimate function, which can be treated as a convolution of the optimal circuit criteria. A labyrinth theory of artificial intelligence is the basis of the proposed procedure for the structural synthesis of circuit design and the problem of a narrowly directed search in state space is solved by the introduction of a number of heuristic approaches (dynamic variation of the estimate function, reordering of the set of operators). Flow chart algorithms are adduced for the

synthesis of transistorized logic circuits; the example of the synthesis of a NAND gate is discussed where the procedure is based on such criteria as circuit speed and static noise immunity. Still, the optimum logic structure is obtained through the convolution of the optimality criteria and a system of expert evaluations. This paper is included in a special number of IZV. VUZ: RADIOELEKTRONIKA devoted to automation of circuit engineering design. Figures 2; references 9: 7 Russian; 2 Western.

USSR

UDC 621.372.001.24:681.3

DIGITAL MODELING ON PROGRAMMABLE MICROCALCULATORS

Moscow IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 6, Jun 79 pp 82-89
manuscript received 23 Jan 79

TROKHIMENKO, YA. K. and LYUBICH, F. D.

[Abstract] The "Elektronika BZ-21" programmable pocket calculator with 15 memory registers (including two operational ones) is used to model non-recursive filters of no less than the sixth order. Other cases analyzed are: 1) A program for a 13th order Barker code sequence filter; 2) A third order Butterworth filter with a specified transfer function and an attenuation of 3 dB at 1 KHz, where the digital model applies to a frequency range of 0 to 50 KHz; and 3) A piecewise-linear approximation of a diode is used to analyze the transient response of a half-wave rectifier. Some 12 specific routines are given, and the digital treatment of the specific analytical expressions is shown. Figures 4; references 7: 6 Russian, 1 Western.

USSR

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THE "INZHENER-2A" AUTOMATED COMPLEX OF PROGRAMS FOR THE ANALYSIS OF LINEAR ELECTRONIC CIRCUITS

Moscow IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 6, Jun 79 pp 99-101
manuscript received 5 Dec 78

LOVKIY, V. K.

[Abstract] The "Inzhener-2A" automated program complex is intended for the analysis of electronic circuits containing R, C and L elements, voltage controlled current sources and transistors (models of which are stored in the library) on the Mir-2 computer. Models of operational amplifiers and

other linear IC's and assemblies containing these elements can be included where necessary; the permissible complexity of the analyzed circuits run up to 15 nodes and 50 to 70 components (5 to 7 transistors). The routines are stored on one perforated tape with program separators. The "Inzhenev-2A" complex derives circuit functions in literal and alphanumeric form, plots the frequency response of the derived circuit functions in selected portions of the frequency range both with a fixed and automatically selectable step for various parameters of the components, specified in literal form, determines the stability of the circuit design with a specified change in circuit parameters, finds the transient and pulse response of the circuit for specified values of the parameters, as well as for various sets of these values and plots the timewise response of networks with an arbitrarily specified input and various circuit parameters. The set includes six basic and three auxiliary routines and automatically normalizes the parameters when entered and denormalizes them when printing out the results; all the quantities are specified in primary units such as kilohms, microfarads, henries, KHz, msec, etc.). Figures 1; references: 2 Russian.

USSR

UDC 621.372.061

THE ANALYSIS OF ELECTRONIC CIRCUITS WITH THE JOINT USE OF EXPLICIT AND IMPLICIT INTEGRATION METHODS

Moscow IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 6, Jun 79 pp 27-31
manuscript received 21 Nov 78

NORENKOV, I. P., ZHUK, D. M., MANICHEV, V. B. and TRUDONOSHIN, V. A.

[Abstract] In developing the overall structure of a software system for circuit analysis problems, the development of the control program is more complex in the case of a structure based on small modular routines. However such a structure is more advantageous because: 1) The set of programs is open to a greater extent, i.e., it is easier to incorporate newer, more refined algorithms and models into the complex; and 2) The user gains the capability of constructing more diverse chains of routines when running a draft design. The other approach to software system design is predicated on the use of larger modular routines, which simplifies the realization of the intermodular links in the set of programs, but complicates the expansion of the software package because the majority of possible changes requires the development of a new large routine module. Programs have recently appeared (the first of which was the PA-4), in which methods of substantially different classes, i.e. explicit and implicit integration, are realized. However, the selection of the requisite method is left to the user. A consequence of this nonautomatic selection is that the option of changing procedures in the execution of a particular analysis variant is not possible.

The present paper substantiates the expediency of the automated selection and changing of the explicit and implicit procedures during the process of solving a system of differential equations which describe the transient processes in an electronic circuit, something which is an argument in favor of a software system based on smaller routine modules. The results of analyzing the transient response of an RCL network show that the machine times required for explicit and implicit integration are 1,525 and 1,011 seconds, respectively and 554 seconds for the combination procedure. Machine time requirements and the number of integration steps are also presented in tabular form for the circuit analysis of TTL, ECL and DC amplifier circuits, which again shows the advantage of the combined approach. This paper is included in a special number of IZV.VUZ:RADIOELEKTRONIKA devoted to automation of circuit engineering design. Figures 3; tables 2; references: 4 Russian.

USSR

UDC 621.374

ANALYSIS OF SAMPLED-DATA SYSTEMS WITH VARIABLE PULSE-REPETITION PERIOD

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian No 1, 1979 pp 27-30 manuscript received 7 Mar 78

IVANOV, V. A. and KORNYYUSHIN, YU. P.

[Abstract] A pulsed automatic control system is analyzed in which the pulse-repetition period is a given function of time. The instantaneous time at discrete instants of the pulse train is normalized. To derive an equation reflecting the dynamics of the given pulsed automatic control system, use is made of the integral relation between the input of the continuous part of the automatic control system and its response. Included in this equation is an expression for the lattice function of the pulse instant and the weighting function of the pulsed system. An example is given of a pulsed automatic control system, with numerical values for the parameters. The paper was recommended by the Department (Kafedra) of Automatic Systems, Moscow Higher Technical College imeni N. E. Bauman.

APPLICATION OF LUMPED-SPECTRUM SIGNALS AND ASYNCHRONOUS RECEPTION METHOD IN TELEMETRY

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian No 1, 1979 pp 13-19 manuscript received 27 Mar 78

ALIYEV, T. M., AKOPYAN, R.A., MELIK-SHAKHNAZAROV, A.M. and SHAKHMARDANOV, SH.M.

[Abstract] For more efficient telemetering of information from dispersed objects and other objects that have narrow-band channels and high interference, lumped-spectrum signals are proposed for the transmitting side, and an asynchronous reception method for the receiving side. As to the operating principle of this telemetry signal, the elementary signal of the transmitted code combination can be represented as a radio-frequency pulse with intra-pulse frequency deviation in the range f to $f + \Delta f$. Reception of the elementary signals of the coded pulse train is proposed to be done with an asynchronous receiver; its frequency selector is an asynchronous filter. This filter is a series combination of a low-Q bandpass filter, a synchronous detector controlled by a reference generator and a low-pass filter with a time constant wholly determining the pass band of the asynchronous receiver. The elementary signal of the pulse train is selected by having the response of the inertial system to this signal dependent on the rate of frequency change at the instant the system transits resonance status. Included in this paper is an example of calculating the parameters of a telemetry system with a frequency band of 2000 to 3000 Hz, and a maximum possible spread of the generator frequencies at the transmitting and receiving sides of 20 Hz. The paper was recommended by the Department (Kafedra) of Information-Measuring and Computing Techniques, Azerbaydzhan Institute of Petroleum and Chemistry imeni Azizbekov.

EFFECTIVENESS OF AUTOMATION OF DESIGN AND MICROCALCULATORS

Moscow IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 6, Jun 79 pp 3-6

TOROKHIMENKO, YA. K., dr in technical sciences, professor, Responsible Editor of IZV.VUZ:RADIOELEKTRONIKA

[Abstract] The role of pocket calculators, particularly programmable types, in the design and automation of radio electronic equipment in the future and at present is analyzed from an economic viewpoint. A major justification for the expanded application of pocket size programmable calculators is the following general rule: it is not economically expedient to solve a problem on a particular computer which can be solved on a computer having a lower machine time cost. The latter is generally true of pocket calculators

and accounts for the regular publication of numerous articles devoted to algorithms and programs for the solution of engineering problems on such calculators as the HP-25, which are close in terms of performance to the "Elektronika BZ-21". It is difficult to overestimate the significance of this "small scale" automation of engineering design calculations using such small programmable calculators. Because the general criterion for design quality is its economic effectiveness, a negligent attitude towards the utilization of such an economically efficient tool as the small programmable calculator is impermissible. This paper is included in a special number of IZV.VUZ: RADIOELEKTRONIKA devoted to automation of circuit engineering design.

USSR

UDC 681.513.3

A PROBLEM OF FUNCTIONAL INTERCHANGEABILITY FOR NONLINEAR SERVO SYSTEMS WITH RANDOM INPUTS

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian No 1, 1979 pp 40-43
manuscript received 10 Feb 78

BULOVSKIY, P. I., METKIN, N. P., LYUBIMOV, I. A. and SUVOROV, S. M.,
Leningrad Institute of Aviation Instrument Making and Leningrad Electrical
Engineering Institute of Communications imeni professor M. A. Bonch-
Bruevich

[Abstract] Functional interchangeability of systems is examined for instrumented servo systems with random inputs. For functional interchangeability in the general case, we must know the density of the probability distribution of the system functioning criterion. In a servo system the servo variance is usually the functioning criterion. A statistical linearization method was used in finding these characteristics. To verify the theoretical analysis, a statistical model of the functioning of a specified servo system was constructed. A minsk 22 computer was used in solving the statistical modeling problem by the Monte-Carlo method. The paper was recommended by the Department (Kafedra) of the Technology of Instrument Making, Leningrad Institute of Aviation Instrument Making. Figures 3; references: 5 Russian.

USSR

UDC 621.397

TRANSMISSION OF A VIDEO SIGNAL ON TWO CARRIER FREQUENCIES

Moscow RADIOTEKHNIKA in Russian Vol 34, No 5, May 79 pp 73-75 manuscript
received 23 Jun 78

KOVALENKO, V. I.

[Abstract] A previous paper showed the advantages of transmitting a video signal on two carriers in a common frequency band with the carriers symmetrically located relative to this band [see V. I. Kovalenko, "Radiotekhnika," 1978, Vol 33, No 12]. In the present article, a more detailed examination is made of the various kinds of distortions that arise in this type of transmission in comparison with the distortions in conventional single-band transmission: the influence of instability of the heterodyne in the receiver converter on frequency distortions of the video signal; the influence of the difference frequency on reception quality; cross-talk distortions; frequency distortions; phase distortions. The results show that the proposed transmission system introduces no additional distortions as compared with the conventional system. Figures 5; references: 2 Russian.

USSR

UDC 778.534.83-52

AN AUTOMATIC CONTROL SYSTEM FOR HIGH-SPEED MOTION PICTURE CAMERAS

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 6, Jun 79 pp 22-26

KONOVALOV, N. A. and LAKHNO, N. I., Institute of Mechanics, Academy of Sciences of the Ukrainian SSR, Dnepropetrovsk branch

[Abstract] An automatic control system is described which was developed for an SKS-1M high-speed motion picture camera, or a pair of them, with continuous film winding. It consists of a time-base recording device, a power supply for the motors, and a synchronizer--all contained in a MIK-73M panel box. The recording device includes a quartz master oscillator, four decade frequency dividers, five pulse-width shapers, a pulse amplifier, and OR logic, and two neon lamps controlled by transistor switches. The power supply includes a thyristor voltage regulator with an isolation transformer separating the power circuit from the control circuit. The synchronizing device consists of a programmer and a controller, altogether 5 transistor relays and 24 miniature electromagnetic relays. The design of these components matches the performance characteristics of SKS-1M cameras, in terms of frame speed and frame time, over the 40-200 V range of operating motor voltages. The system, tested in 1975-77 and certified, improves significantly

the precision of filming for scientific research. Further improvements should include a higher degree of microcircuit integration, introduction of digital control and digital stabilization of film speed, also standardization of controlled thyristor switches for measuring and lighting equipment. Figures 8; references: 11 Russian.

USSR

UDC 778.534.452

A LASER LIGHT-MODULATOR FOR RECORDING OF VARIABLE-WIDTH SOUND TRACKS

Moscow TEKHNICA KINO I TELEVIDENIYA in Russian No 6, Jun 79 pp 3-7

GLAZUNOVA, V. I., TSIFRINOVICH, L. G. and EZROKH, L. I., TsKB NPO "Ekran"
[Central Design Office, Scientific-Industrial Association "Ekran"]

[Abstract] Research done at the All-Union Scientific-Research Institute of Motion Pictures and Photography (NIKPI) together with the Leningrad Institute of Motion-Picture Engineers (LIKI) on the quality of sound tracks in film copies for mass distribution has revealed that the degradation of sound transmission quality in the duplication process is caused by a narrowing of the frequency band and an increase of nonlinear distortions. A very effective method of overcoming this problem would be direct-positive duplication from the original. This has been made feasible by a new method developed at the Central Design Office of the Scientific-Industrial Association "Ekran" which involves the use of a laser light modulator. A variable-width sound track can be recorded, with the laser beam deflection angle remaining constant regardless of the audio signal level. In addition to a gas laser, the device includes an optoacoustic diffractive deflector controlled by signals from a tunable ultrasonic-frequency oscillator with linear frequency modulation by a sawtooth voltage generator, and an optical shutter controlled by signals with pulse-width modulation. The entire width of the sound track is covered while the light beam scans a line. A laboratory prototype of such a device has been built and tested. Its performance was found to ensure high speed and high fidelity of sound track recording with an improved overall economy of mass reproduction. Figures 5; references 8: 7 Russian, 1 Western.

Certain Aspects of Radioastronomy,
Satellites and Space Vehicles

USSR

TELEMETRY FROM ORBIT

Moscow RADIO in Russian No 3, Mar 79 pp 18-19

LABUTIN, L., UA3CR, USSR Master of Sport

[Abstract] Since the first amateur radio satellite was launched on 26 October 1978, considerable experience has been gained in the operation of amateur radio via satellites. This article describes the principles of design of the telemetry system carried on the satellite, which sends to earth such information as the power supply voltage, temperature in various sections of the satellite, and which solar panel is receiving sunlight at the moment, allowing the condition of the on-board systems to be analyzed. The telemetry system, designed by A. Papkov, contains 54 microcircuits with MOS structure and consumes 4 mA at 9 V. The measurement error is less than 1.5 percent and the total mass of the telemetry unit is about 200 g. A full telemetry frame consists of 30 time-separated channels, each channel consisting of four characters: a letter to identify the channel, two decimal digits of information and a letter indicating operation of the relay unit. The 30 parameters measured, their intervals of measurement and literal address are presented. Figures 2.

USSR

UDC 523.16-522.21

A SUBMILLIMETER TELESCOPE FOR THE SALYUT-6 MANNED ORBITAL STATION

Moscow RADIOTEKHNIKA in Russian Vol 34, No 5, May 79 pp 33-40 manuscript received 28 Dec 78

SALOMONOVICH, A. YE., BAKUN, V. N., KOVALEV, V. S., SIDYAKINA, T. M., KHAYKIN, A. S. [deceased], ISKHAPOV, B. O., DUL'KIN, L. Z., KOVKOV, V. A., KOSTYUKOVICH, V. I., CHEMODANOV, B. K., SEN'KO, L. A., MOL'KOV, V. A., OVCHINNIKOV, V. S., GRIGOROV, E. I., MAGDESYAN, A. L., NIKONOV, A. A., POLUEKTOV, V. P., PUCHININ, A. V., GERASIMOV, I. A. and SEROV, A. V.

[Abstract] The article describes the design and characteristics of the BST-1M submillimeter telescope installed on the Salyut-6 manned orbital station. This telescope includes the optical system, an active cooling system, a support system for the cooling system, an amplifying and recording system, and a control system, all accommodated in the science compartment of the satellite. The diameter of the main dish is 1500 mm, the secondary (hyperbolic) dish has a diameter of 250 mm. The focal length of the objective is 5013 mm, and the angle of view is 18'. The instrument has sensitivity ranges of 0.2-0.26, 60-130 and 300-1000 μ m. Maximum sensitivity in

the submillimeter range if 10^{-12} W/Hz $^{1/2}$. There are three amplification channels with an output voltage range of 0-6 V. In experiments the telescope has been used to measure submillimeter emission of the earth's atmosphere. The ultraviolet channel has been used in relative photometry of a number of stars, and also to record the setting of bright stars beyond the earth's horizon in order to analyze the behavior of the ozone layer during nighttime. Results are being processed. Figures 5; references 11: 9 Russian, 2 Western.

USSR

UDC 621.396.96:621.391.26

DIRECTION FINDING FOR RANDOM AND UNKNOWN SIGNAL SOURCES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79 pp 711-719
manuscript received 21 Oct 77

FAL'KOVICH, S. YE., PISKORZH, V. V. and PONOMAREV, V. I.

[Abstract] Direction finding is carried out in the far field of point radio sources against a noise background using a linear antenna system. The DF signal takes the form of a narrow band process, and depending on the nature of the signal three cases are distinguished: a) An unknown signal with an unknown bandwidth (DFing a source of specified radiation with an unknown type of modulation, but with a known center frequency and spectral width); b) A random signal (the radiation of radio stars and the thermal radio emission of ground objects); and c) An unknown signal with an unknown bandwidth, which differs from case "a" in that the center frequency and the bandwidth are unknown. The background noise is assumed to be a statistically independent normal steady-state process with a uniform spectrum in the signal bandwidth or a wider frequency range. Algorithms are synthesized using a maximum plausibility procedure to estimate the angular coordinates, as well as the spectral intensity of the source signal. The precision in measuring the angular coordinate and spectral intensity of the radio source 3C273B is used as an example. This source has a spectral flux density of $4.49 \cdot 10^{-25}$ W/m 2 Hz at 5 GHz. The receive channels have the following specifications: a spectral width of 10 MHz, $T = 400$ sec, an equivalent noise temperature of 1000 K ($N_0 = 4kT = 5.5 \cdot 10^{-21}$ W/Hz and the effective area of one antenna was 2 m 2). Using these parameters and the analytical expressions derived in the paper, it is found that the dispersion in the angular coordinate measurement is approximately $3 \cdot 10^{-7}$ and the relative error in measuring the spectral intensity is approximately 0.007. It is noted that the type of signal processing described in the IEEE TRANSACTIONS by MacPhie and El-Benery in 1976 yields estimates of the angular coordinate and spectral intensity which are approximately $(M)^{1/2}$ times worse than the optimum algorithms given in this paper (M is the number of signal realizations). References 6: 5 Russian, 1 Western.

USSR

UDC 621.316.9.01

ON ANALYZING THE FIELD OF LIGHTNING CURRENT IN TWO-LAYER GROUND

Minsk IZV.VUZ: ENERGETIKA in Russian No 4, Apr 79 pp 13-19 manuscript
received 17 Aug 78

DUL'ZON, A. A., KUPTSOV, A. M. and LISETSKAYA, M. N., candidates in technical sciences, docents, Scientific-Research Institute of High Voltages at Tomsk Polytechnical Institute imeni S. M. Kirov

[Abstract] An examination is made of the problem of damage to underground communication cables by lightning in regions where permafrost conditions produce a two-layer medium in which the thawed upper layer has earth conductivity of 10^{-2} - 10^{-5} S/m, while the lower layer is frozen with earth conductivity of 10^{-5} S/m. In warm months the thawed layer may be 1-3 m thick, and the layer of frozen ground is 70-100 m thick. An analysis is made of the influence that this two-layer inhomogeneity has on the distribution of potential and electric field strength of lightning currents in the earth without consideration of biasing currents. It is shown that potentials and field strength are greater than in a homogeneous medium because of the poor conductivity of the lower layer. This effect increases with a reduction in thickness of the upper layer. The field strength at the interface on the poorly conductive side is 2-10 times as high as that on the side with higher conductivity. The presence of a region with elevated field strength in the lower layer may lead to the formation of a zone of ionization with greater radius than in the upper layer. The increase in field strength at the interface on the lower side is one of the reasons for the increased zone of damage to communication cables by lightning currents. Figures 4; references 3: 2 Russian, 1 Western.

USSR

UDC 621.391

L.I. MANDEL'SHTAM'S PROBLEM IN RADIO TECHNOLOGY AND ELECTRICAL COMMUNICATION

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 5, 1979 pp 3-19 manuscript
received 20 Jun 78

LANNE, A. A. and SIKAREV, A. A.

[Abstract] The essence of the problem is the appropriate selection of phases of harmonic constituents of various frequencies of a complex oscillation (signal) in order maximally to reduce the instantaneous value of this oscillation, a problem pointed out by L. I. Mandel'shtam. In spite of its apparent simplicity, no analytical or numerical solution to the problem has yet

been found. There are no known methods of constructing global-optimum solutions of problems, but local-optimum numerical solutions may be based on methods of nonlinear programming or minimax methods. The use of a quadratic criterion often greatly simplifies the problem; in many instances it is dictated by the opinion that the maximum absolute error in the quadratic problem instead of the minimax often leads to physically meaningless results where a reasonable engineering solution might be found, and consequently it is advisable to use the minimax approach in some problems of signal theory. Figures 3; references 22: 18 Russian, 4 Western.

USSR

UDC 621.391.2

AN OPTIMUM METHOD OF RECEIVING PULSE AMPLITUDE MODULATION SIGNALS UNDER CONDITIONS OF NARROW-BAND INTERFERENCE AND FLUCTUATION NOISE

Moscow RADIOTEKHNIKA in Russian Vol 34, No 5, May 79 pp 46-49 manuscript received after completion, 21 Nov 78

ARZAMASOV, YU. N. and KRIVOSHEYEV, V. I.

[Abstract] An algorithm is constructed for evaluating the amplitude of a useful pulse signal against a background of narrow-band interference and white noise. The proposed algorithm is optimum with respect to the criterion of maximum likelihood. The analysis is based on a quasi-deterministic representation of narrow-band interference that has been shown to be effective in problems of synthesizing optimum receivers of discrete signals. Results of analysis of the operation of the algorithm are given as well as data on experimental verification of workability in reception of a PAM signal in the presence of AM interference. The results show that the proposed algorithm should be effective for PAM reception against a background of narrow-band interference and powerful pulse interference that does not overlap with the useful pulse signals in time. Figures 3; references: 2 Russian.

USSR

UDC 621.391.278

OPTIMIZING THE STORAGE TIME IN A SYSTEM FOR TRACKING A COMPLEX SIGNAL

Moscow RADIOTEKHNIKA in Russian Vol 34, No 5, May 79 pp 55-58 manuscript received 1 Jul 77

SMIRNOV, N. I. and ZALICHEV, N. N.

[Abstract] An analysis is made of conditions of synchronization of a data

transmission system with code separation of the information and synchronization signals. It is assumed that a continuously emitted synchrosignal is received and goes from the receiver output to a tracking unit, where it is isolated by a matching filter. When the synchrosignal exceeds the threshold, a lock-in unit operates that introduces initial conditions with respect to frequency and time, and actuates a synchrosignal filtration unit. The output signal from this circuit goes to the information signal processing unit. Expressions are derived for the optimum storage time in the tracking unit that minimizes the average time of detection of the synchrosignal in a synchronization channel made up of the tracking unit, filtration unit and lock-in unit. It is found that the von Neumann-Pearson and ideal-observer criteria give an optimum storage time of the same order when the signal-to-noise ratio at the input of the tracking unit is greater than unity. When this signal-to-noise ratio is less than unity, the ideal-observer criterion should be used, as it gives a shorter optimum storage time. For both criteria, the average time for detection of the synchrosignal in the synchronization channel is about the same as the optimum storage time. Figures 3; references: 11 Russian.

USSR

UDC 621.395.625.3

ON NONLINEAR DISTORTIONS OF A WIDE-BAND FM SIGNAL

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian No 4, 1979 pp 10-12
manuscript received 17 Mar 78

RYZHANOVSKIY, A. S.

[Abstract] Signal distortion in precision magnetic recording (TMZ) devices must be taken into account when measuring the characteristics of processes in information measuring systems which contain TMZ devices. Nonlinear distortions are measured for the method of recording with broad-band frequency modulation. Early studies analyzed models of a magnetic record and playback circuit (TsMZV) which did not take into account layer losses in the magnetic carrier (MC); it would be more accuracy to utilize a TsMZV with a transmission coefficient that takes account of layer and contact losses and the differentiating action of the playback head. Harmonic coefficients increase exponentially with an increase in the ratio of modulated signal frequency to the rate of magnetic carrier transport and the ratio of constant and delta values of angular frequency of the FM carrier to magnetic carrier transport. The paper was recommended by the Department (Kafedra) of Radio Reception and Processing of Radio Engineering Information, Kiev Polytechnical Institute. References: 5 Russian.

ON THE STATISTICAL CHARACTERISTICS OF INTEGRATED 'DECISION FEEDBACK'

Moscow RADIOTEKHNIKA in Russian Vol 34, No 5, May 79 pp 41-46 manuscript received 30 Aug 78

KHVOROSTENKO, N. P.

[Abstract] In zero-lag "decision feedback" each decision that is made on the value of a transmitted symbol is immediately used to demodulate the following information symbols. The methods used for studying the statistical characteristics of the zero-lag case [see S. M. Kartushin, N. P. Khvorostenko, "Radiotekhnika," Vol 30, No 3, 1975] are also applicable to inertial "decision feedback" in which the results of using previous solutions are accumulated (averaged) to damp out the influence of noises and previous wrong decisions. In this paper the author uses these methods to analyze the statistical characteristics of a special case of inertial "decision feedback"--integrated "decision feedback." In this system, a binary decision made in a device based on a quasi-coherent detector that receives the input signal is used to shape a reference signal that acts on this same detector. By increasing the memory volume in the reference signal channel, such systems can give practically ideal coherent reception. The interference immunity and parameters of unsteady processes in systems with integrated decision feedback are studied. Figures 5, references: 5 Russian.

FIBER-OPTICS COMMUNICATION LINES AND PRINCIPLES OF CONSTRUCTING THEM

Moscow RADIOTEKHNIKA in Russian Vol 34, No 5, May 79 pp 25-32 manuscript received 20 Jan 78

GULYAYEV, YU. V., POTAPOV, V. T., SOSNIN, V. P., TREGUB, D. P. and ELENKRIG, B. B.

[Abstract] An examination is made of ways to increase the information handling capacity of fiber-optics communication lines, and descriptions are given of possible sources, receivers, commutators and repeaters for the optical wave band with an analysis of their operation. The paper also gives the results of a study of a fiber-optics line developed by the Institute of Radio Engineering and Electronics with a throughput of 500 Mbit/s. The near future should see the development of fiber-optics lines with a throughput of 50-100 Mbit/s using LEDs as the source of emission. Problems remaining to be solved include the development of special LEDs, investigation

of the problems of matching the light emission to the fiber, development of matching devices and semiconductor devices for power supply to the LEDs, and also the production of optical cable and connectors. Fundamental research is also needed in order to develop semiconductor lasers with a service life of 10^4 - 10^5 hours as well as investigation of the peculiarities of operation of semiconductor lasers in actual fiber-optics communication lines with transmission of subnanosecond pulses. The authors thank A. V. Sokolov for discussion of the work and constructive criticism. Figures 12; tables 1; references 14: 7 Russian, 7 Western.

USSR

UDC 621.396.22.029.7

THE STATISTICAL CHARACTERISTICS OF AN ESTIMATE OF THE TIME OF ARRIVAL OF A RECTANGULAR OPTICAL PULSE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79
pp 733-739 manuscript received 23 Nov 77

YEGOROV, V. V.

[Abstract] The precision in estimating the maximum likelihood of the arrival time of an optical signal with a rectangular waveform has been analyzed in the literature, where primary attention is devoted to the problem of obtaining the lower bound for the dispersion of the estimate, particularly in the case where the ratio of the average number of noise photons in the count observation interval to the average number of signal photons in this interval is much greater than one. Opinions differ concerning the effectiveness of estimates of the maximum likelihood value as compared to simpler ones determined by the likelihood function exceeding a threshold value where the signal-to-noise ratio and the above mentioned photon ratio are both much greater than unity. A Poisson photon flux is assumed and analytical expressions are derived for the distributions of the estimate of the maximum likelihood and the estimate based on the first instance the arrival time likelihood function exceeds a threshold value. The gain in precision of the maximum likelihood estimate over the estimate based on the initial passing of the threshold level is shown to be $8/49$ of the signal-to-noise ratio where this ratio is much greater than unity, and the presence of a minimum is noted in the center of the observation interval for the maximum likelihood estimate in the absence of a signal. References 7: 6 Russian, 1 Western.

THE SEQUENTIAL DETECTION OF A CORRELATED GAUSSIAN SIGNAL IN WHITE NOISE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79 pp 720-732 manuscript received 23 Dec 77

SOSULIN, YU. G., TARTAKOVSKIY, A. G. and FISHMAN, M. M.

[Abstract] The problem of synthesizing sequential detectors for correlated signals has come up against the difficulty of finding the optimum threshold levels for the resolvers in these units, something which is due to the difficulties involved in solving multidimensional boundary problems with moving boundaries. Questions have been insufficiently studied which are related to estimating the efficiency of sequential procedures as compared to classical ones in situations which do not allow for the replacement of the unit which compares the logarithm of the likelihood ratio to the two constant thresholds by a unidimensional Markov process. This paper is devoted to the solution of these synthesis and analysis problems where the useful signal is a gaussian Markov process and the interference is gaussian white noise. The derived sequential detection algorithm was simulated on M-4030 and BESM-6 digital computers; the average detection time is plotted as a function of the signal-to-noise ratio as is the efficiency of sequential detection. The latter is also plotted as a function of the useful signal correlation time. Computer simulation showed that one of the sequential resolution rules yields an insignificant gain in the average detection time (on the order of 1 percent) where the signal-to-noise ratio is less than 0.3 and the error probability is 0.1. The efficiency of the simplest sequential resolving rule as compared to the classical rule is better, not only in the detection of weak correlated signals where the simpler rule is asymptotic to the optimal one in the class of all detection rules, but also in the detection of strong signals when this rule is not optimal. Neither of these algorithms was simulated for signal-to-noise ratios of less than 0.3 because of the large amount of computer time required. Figures 5; references 12: 11 Russian, 1 Western.

THE DETECTION OF A LOCALIZED RANDOM FIELD

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79 pp 745-750 manuscript received 6 May 78

LAPSHIN, V. M.

[Abstract] A system consisting of m discrete omnidirectional elements

receives a signal which can act only on one of these elements, the specific element being unknown. This corresponds to the case where the signal field is localized in space and the linear dimensions of the region where the signal field is nonzero are less than the spacings between the receivers. The signal is assumed to be a steady-state, random process and that the interference does not depend on the signal, is additive and is described by a sequence of steady-state, random m -dimensional vectors with a zero vector of the average and with a specified matrix power spectrum. The signal detection problem is formulated as a multiple alternative problem of testing hypotheses with respect to the distribution of a correlated sequence of random vectors. The configuration of an optimal digital filter is synthesized for the case of an observation time which is much greater than the signal and noise correlation times. The detection system consists of two parts: a linear section which serves to detect the specified signal component. Other variants of the detection system are possible, such as those based on the use of a discrete Fourier transform. It is found that the device which filters the nonzero signal component with minimal dispersion is identical to a group filter of the localized field detector. It is shown that this group section of the detector, which plays the part of an external noise compensator, can be synthesized for the case of unknown noise based on an unclassified teaching sample. An important case in application arises when the primary contribution to the interference is made by noise sources concentrated in space. Under certain conditions in this case, the interference is completely compensated and the detection problem becomes a singular one. References 5: 2 Russian, 3 Western.

USSR

UDC 621.396.96:621.391.828

THE ADAPTIVE RECEPTION OF RADIO SIGNALS WITH AN UNKNOWN FREQUENCY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79 pp 765-773 manuscript received 5 Sep 77

TIKHONOV, V. I. and YEFIMENKO, V. S.

[Abstract] Two approaches to adaptive reception are analyzed: 1) A preliminary teaching mode in which the adaptive receiver consists of a nonadaptive receiver which processes the radio signal having an unknown carrier frequency and an optimal teaching unit which is intended for a preliminary estimate of the frequency based on a test signal (the teaching sample). Upon the completion of the test signal, the teaching unit forwards the information on the unknown frequency estimate to the nonadaptive receiver, i.e., to the optimum receiver for the unknown frequency signal; 2) A self-teaching mode in which the receiver consists of a reference signal generator and a correlator which employs the received signal and the signal estimate in order

to derive a likelihood ratio which is fed to a threshold gate for the decision making process. Quasi-optimal algorithms are derived for both the preprogrammed and self-teaching detectors and the behavior of the detectors is studied with a Monte-Carlo approach. Detection probability is plotted as a function of various detector parameters and block diagrams of the detectors are shown. The optimal and quasi-optimal detection algorithms are compared graphically. Figures 11; references: 10 Russian.

USSR

UDC 621.396.969.14

MEASUREMENT OF SIGNAL FREQUENCY AGAINST A BACKGROUND OF NOISE USING DIGITAL PHASE AFC SYSTEMS

Moscow RADIOTEKHNIKA in Russian Vol 34, No 5, May 79 pp 78-80 manuscript received 17 Nov 78

ANTSIBOR, N. M. and ZHODZISHSKIY, M. I.

[Abstract] An examination is made of different algorithms for measuring the frequency of a noise-masked signal by using digital phase AFC systems to get around the disadvantages of conventional frequency-measurement techniques. An analysis is made of noise errors and errors caused by measurement discreteness. For the purposes of the analysis, phase AFC systems are divided into two groups. The systems of the first group are those in which analog-digital conversion is done in the digital phase detector that simultaneously measures the phase mismatch. Such systems are digital-analog units since the output signal is in analog form. In systems of the second group, analog-digital conversion of the input process takes place preceding the loop of the phase AFC system. Since input and output are digital in this case, the entire system is designed as a digital unit. The results show that digital phase AFC systems can be used for fairly simple and accurate measurement of the phase of an acyclic waveform, i.e. one in which the phase variation is not limited to a period with length 2π . This means that relatively simple quasi-optimum algorithms can be used to measure the frequency of a noise-masked signal. The authors thank V. A. Veytsel' and V. V. Vasil'yev for constructive criticism conducive to improvement of the work. Figures 1; references 8: 6 Russian, 2 Western.

USSR

UDC 534.86

SYNTHESIS OF SURFACE ACOUSTIC WAVE FILTERS WITH ASYMMETRICAL AMPLITUDE-FREQUENCY CHARACTERISTICS

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 5, 1979 pp 87-88 manuscript received 19 May 78

BIDENKO, V. A., GRANKIN, I. M., NELIN, YE. A. and POGREBANYAK, V. P.

[Abstract] The need to synthesize surface acoustic wave filters with asymmetric amplitude-frequency characteristics (AChKh) arises when developing a filter for an IF image amplifier (UPChI) in a television receiver. Most methods of filter synthesis involve complicated calculations and manufacturing problems. With certain constraints on the shape of the amplitude-frequency characteristic, this method simplifies synthesis and manufacture of filters. The frequency characteristics of a filter consisting of apodized and non-apodized converters is equal to the product of the converters' characteristics. If the converter periods are different, the filter AChKh will be asymmetrical. Varying degrees of asymmetry can be produced according to the relationship between AChKh parameters of the converters. Significant asymmetry can be realized. Synthesis was accomplished by the method of successive approximations. The AChKh of the filter synthesized by the proposed method meets requirements imposed on a UPChI filter with the reserve necessary to compensate for errors of practical realization. Figures 3; references 2: 1 Russian, 1 Western.

USSR

UDC 621.372

NEW APPROXIMATION MODE FOR SYNTHESIS OF FILTERS

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 5, 1979 pp 44-50 manuscript received 20 Dec 77; after revision, 5 May 78

GUSEVA, M. N.

[Abstract] The Chebyshev and Butterworth polynomials are traditional forms of approximation in the synthesis of filters in terms of the modulus of the transmission function. Theoretical relationships used to define filter elements are generally derived by comparing coefficients for variables with equal powers of the approximating polynomial and the polynomial of the filter transmission function of a single order-- n . In calculating ideal devices this solution is satisfactory, but with dissipative losses found in actual equipment it lacks precision. Approximate solutions must therefore take these losses into consideration. In a filter with identical loaded

quality factors of resonators, the magnitude of dissipative losses in the bandpass under identical initial conditions can be significantly reduced with some reduction of the characteristic slope of the amplitude-frequency curve (AChKh) in the elimination band. Figures 4; tables 2; references: 4 Russian.

USSR

UDC 621.385.6:621.382

DESIGN VARIANT OF MICROWAVE FILTERS AND SELECTIVE MIXERS WITH MAGNETIC RETUNING

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 5, 1979 pp 88-92 manuscript received 28 Feb 77; after revision 20 Oct 78

GOLOBOV, V. P., ISHCHEKNO, M. G., TUREYEVA, O. V., TSYMBAL, V. I. and SHELOMOV, G. N.

[Abstract] A basic trend in the evolution of modern microwave electronics is a shift toward multifunctional systems: a combination in a single module of several monofunctional passive and active devices. Wide-range superheterodyne microwave modules with magnetic retuning are related to such systems: within a single magnetic system are arranged a ferrite filter, heterodyne and mixer. Several studies have dealt with ferrite filters with communication loops, but questions about satisfaction of certain specific requirements imposed on ferrite filters when used as preselectors in superheterodyne systems have yet to be sufficiently investigated. In order to explain the values of maximally attainable bandpass and forward losses, an analysis of ferrite filters was made for two brands of ferrite resonators with saturation magnetization of 0.065 and 0.175 tesla. A distinctive feature of selective microwave mixers with magnetic retuning is the possibility of controlling the phase of an IF output signal by measuring the field which magnetizes the FR as is done in ferrite mixers. In addition, selective mixers can be combined in a single device with other types of magnetically-tunable microwave devices, especially with a filter or oscillator in a heterodyne frequency converter. Figures 3; references 9: 8 Russian, 1 Western.

NATURAL WAVES OF A PLANAR-LAYERED ASYMMETRICAL DIELECTRIC WAVEGUIDE

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 5, 1979 pp 59-65 manuscript received 12 Dec 77; after revision, 17 Apr 78

GUDZENKO, A. I. and POLOVINKIN, A. N.

[Abstract] Approximate methods are elaborated for practical calculation of emitted and guided waves of planar-layered asymmetrical waveguides without losses. The complete system of intrinsic waves examined makes it possible rapidly and accurately to perform the necessary calculations by the method of cross sections for some practical applications such as coupling of diffused waveguides, exciting them through various kinds of arrays, and acousto-optical interactions taking place inside them. Dispersion equations can be easily used to solve several important problems on analysis of the effect of the precision of waveguide manufacture on its characteristics, as well as to study the actual experimental distributive functions of permeance. Figures 2; references 10: 6 Russian, 4 Western.

WAVEGUIDE EXCITATION BY NONSTEADY-STATE EXTRANEEOUS CURRENTS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79 pp 682-690 manuscript received 24 Apr 78

MAN'KIN, I. A.

[Abstract] The study of the amplification and generation of a nonsteady-state wideband signal encounters difficulties related to the lack of a nonsteady-state equation for excitation of a field by currents with an arbitrary spectral width. This equation is derived using an inverse Fourier transform applied to the general equations for waveguide excitation by a harmonic current. The derived expressions are valid for quantities which change in an arbitrary fashion in time without any limitation on their spectral width. The resulting integral-differential equation is solved directly for the field excited in an interaction circuit by a nonsteady-state extraneous current. In contrast to published results, the analysis is not limited to narrow band signals; the derived equation is equivalent to a partial differential equation of an infinitely high order, which becomes the well-known first order for narrow band processes. The expressions can be used to study both numerically and analytically the amplification and generation of a wideband (random or specified) signal. References: 8 Russian.

USSR

UDC 621.372.8.029.7

WAVE TRANSFORMATION AT AN IRREGULAR SECTION OF A FIBER OPTIC GAS-DIELECTRIC LIGHTGUIDE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79 pp 657-662
manuscript received 30 Jan 78

MARTYNOVA, T. A. and SHEVCHENKO, V. V.

[Abstract] A gas filled, microcapillary glass tube lightguide is irregular in that the wall deformation produces a section where the distance between the centers of the circumferences of the inside and outside walls of the tube changes in a specified manner. It is assumed that the wall thickness changes sinusoidally in the cross-section of the tube through this irregular section, and linear and square law models for the change are also analyzed. A three-dimensional vector problem is formulated and solved on a BESM-6 computer. The wave numbers and coupling factors of a discrete section of the spectrum are analyzed as a function of the specified variation in the distance between the centers of the inner and outer walls. The ratio of the power of two coupled modes is also analyzed as a function of the rate of change in the above specified parameter along the axis of the lightguide. Dangerous irregularity parameters in the sense of wave conversion losses are indicated graphically and discussed. The irregularity considered here places less stringent requirements on the periodicity of the variations in the lightguide wall thickness. It is sufficient if the periodicity of the variations is on the order of a meter or more. The results presented in this paper were partly reported at the VII All-Union Symposium on Diffraction and Propagation of Waves (Rostov-na-Don, Sept 1977). Figures 6; references: 7 Russian.

USSR

UDC 621.372.8.029.7

LIGHT PROPAGATION IN AN IRREGULAR FOCUSING FIBER WITH RANDOM AZIMUTHAL ASYMMETRY

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79 pp 663-667
manuscript received 28 Jun 78

SHATROV, A. D.

[Abstract] Light from a Lambert source is propagated in a multimode fiber lightguide with a small aperture. The fiber is irregular in that it has random deviations from cylindrical symmetry; the irregularities are assumed to produce an index of refraction of the lightguide core which is an

azimuthal function resulting in random ellipticity. Analytical expressions are derived and plotted graphically for 1) Losses as a function of the length of the fiber; and 2) Patterns of the far and near fields at various sections. It found that even when the irregularities generate rather small additional losses, they lead to a marked departure of the field behavior from the parabolic law. This circumstance must be taken into account when measuring the profile of the index of refraction using a near field or far field method. The author thanks V. P. Mal'tseva for assistance in conducting the numerical calculations, and he is grateful to B. Z. Katsenelenbaum and R. F. Matveyev for helpful discussions. Figures 3; references 6: 4 Russian; 2 Western.

USSR

UDC 621.374.4

PENTADECAD E FREQUENCY SYNTHESIZER USING INTEGRATED MICROCIRCUITS

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian No 4, 1979 pp 69-73 manuscript received 30 May 77

TURGIYEV, E. A., SHEYTMAN, YA. L. and VERDIYEV, T. M.

[Abstract] Some electronic meters and computers use functional units in which one variable is the pulse repetition rate. In this case the device should contain a unit whose output can produce a frequency arbitrarily set within a wide range with sufficiently low discreteness. Several frequency dividers with a code-controlled division coefficient have been described in the literature. They employ counter elements with symmetric connections and pulse outputs, which leads to an increase in the amount of device hardware. Other circuits, however, do not permit frequency production with desired discreteness. A device is described, designed to produce frequencies between 0 and 9999 Hz with 1 hertz discreteness, using K120 series integrated circuits (maximum operating frequency 200 kHz). Operation of the device is based on the fact that pulses corresponding to specific decade states identified by the decoder appear at different moments in time and may be added into a single train. The device consists of a 100 kHz quartz oscillator, five pulse counters (each containing ST 10 decade, DC decoder, OR-adder and AND-strobe), four gates forming parallel carry circuit between decades, five-input OR-adder and composing field for frequency setting. A similar device can be realized using faster IC series (K133, K155, K136, etc.). The appropriate master frequency and number of decades will produce the required accuracy and range of frequency. One shortcoming of the device is the non-uniformity of the pulse train shaped at the output of the frequency synthesizer. The paper was recommended by the Department (Kafedra) of Electrical Measurements and Computation Techniques, Azerbaydzhan Institute of Petroleum and Chemistry imeni M. Azizbekov. Figures 2; tables 2; references: 3 Russian.

GALVANOMAGNETIC DETECTOR ON A BASE OF FERROMAGNETIC FILM IN A RECTANGULAR WAVEGUIDE

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 5, 1979 pp 80-83 manuscript received 10 Jan 78; after revision 12 Jul 78

VUNTESMERI, V. S.

[Abstract] Ferromagnetic film (FMP) galvanomagnetic detectors (GMD) have several advantages over semiconductor GMDs, e.g., less thermal e.d.f., less effect of rectifying contacts and better technological effectiveness. Analysis was performed on the interaction of a GMD in the form of a narrow, thin magnetic film whose thickness is less than the penetration depth, placed between the broad walls of a waveguide. The film is sprayed on a thin glass substrate of the order of 80 micrometers. When an electromagnetic wave falls on the film, the latter gives rise to an electrodynamic force because of the galvanomagnetic effects. The film operates as a parametric detector whose variable parameter—specific resistance of the FMP—is a function of the instantaneous value of the microwave magnetic field intensity. When the GMD is re-tuned by the external magnetic field, the coefficient of conversion has two extreme values with opposite signs; their magnitude depends on the phase shift between current in the film and the transverse constituent of the microwave magnetic field. Galvanomagnetic detectors have speeds on the order of 10^{-7} to 10^{-9} seconds, sufficiently high sensitivity and can be used to measure and monitor continuous and pulsed high-level power. Figures 2; tables 1; references 5: 4 Russian, 1 Western.

EXPERIMENTAL DETECTION OF MICROWAVE OSCILLATIONS USING ROOM TEMPERATURE GaAs VOLUME

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 5, 1979 pp 85-8; manuscript received 10 Apr 78; after revision, 16 Jun 78

MALYSHEV, V. A. and LEVTEROV, A. N.

[Abstract] There are a number of microwave detectors whose operation is based on the use of the properties of semiconductor volume where carriers are heated by an electrical field. The nonlinear elements of these detectors are n-type InSb at 77°K, n-Ge at 4°K and Ge, Si at 300°K. But germanium and silicon have low carrier mobility and specimens of InSb can operate efficiently only at N and H temperatures. A more promising material for detecting microwave signals is gallium arsenide whose detector properties are

usually considered as concomitant effects in Gunn-diode oscillators and amplifiers. The experiments described employed epitaxial films of n-GaAs grown on a highly-alloyed substrate. The lower limiting sensitivity of the detector studied, as compared with Schottky diode detectors and point-contact diodes, with its simultaneously enhanced energy strength because of the use of volumetric properties, permits it to be used in devices where lower limiting sensitivity may be used but where high energy strength is important. The use of the nonlinear properties of the volume of gallium arsenide in heating fields below threshold value makes it possible to create efficient energy-resistant microwave detectors with sufficiently high limiting sensitivity and linearity of dynamic characteristics that operate at room temperature in the millimeter wavelengths. Figures 1; references 9: 7 Russian, 2 Western.

USSR

UDC 621.382.22.029.64

AN INVESTIGATION OF A MICROWAVE FREQUENCY SHIFT MIXER USING A DIODE EMPLOYING THE INTERVALLEY ELECTRON TRANSIT EFFECT

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79
pp 874-875 manuscript received 29 Mar 77

MEDVEDEV, V. D., TIKHOMIROV, A. A. and POSADSKIY, V. M.

[Abstract] A down conversion, three centimeter band mixer is designed around a diode utilizing the effect of intervalley electron transfer. A stable gain mode in conjunction with the nonlinearity of the volt-ampere characteristic of the diode made it possible to provide for simultaneous down conversion and signal gain. The mixer took the form of a coaxial to waveguide junction, and an AA703B diode was placed in the break in the coaxial line. Through appropriate positioning of the diode and setting of the bias voltage level, a stable negative resistance mode was achieved. The input signal was 9.24 GHz, the heterodyne frequency was 650 MHz and the output frequency was 8.59 GHz; the maximum power transconductance of the converter was 8, 6.8 and 0 dB for heterodyne levels of 35, 20 and 7 mw, respectively. In the saturation mode, these values decreased by 1.5 dB, and increasing the heterodyne power above 35 mw reduced the output signal amplitude. The output power is plotted as a function of the input power for the three heterodyne levels, showing essentially a linear relationship; the transconductance is shown as a function of the output frequency between 8.53 and 8.7 GHz, with a peak in the vicinity of 8.60 GHz. The bandwidth of the mixer was determined by the matching of the diode to the external circuitry. Figures 3; references 6: 4 Russian, 2 Western.

STUDY OF LIMITING SUPPRESSION CHARACTERISTICS AND COMPUTER SIMULATION OF NOISE AUTOCOMPENSATOR

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 5, 1979 pp 72-75 manuscript received 26 Sep 78

MARTIROSOV, V. YE. and BELOUSOV, N. N.

[Abstract] Analysis of the noise autocompensator (AKP) was carried out under the assumption that correlated noise signals are observed at all inputs. The zero channel is basic and contains no weighted coefficients. Input signals of the remaining channels are broken down into quadrature constituents and are weighted with variable weight coefficients and then added. In a second adder compensation is performed for noise entering through the main channel. Because of the unwieldiness of mathematical transformations for matrices with higher orders, a digital computer was used to compute the results. When τ_0 approaches zero, suppression increases and there is a substantive relationship of values of the suppression factor as a function of the number of AKP inputs; optimum weight coefficients of AKP are harmonic functions of τ_0 with exponentially diminishing amplitudes; frequencies of the harmonic functions equal $j\omega_0$. A computer simulation of a multichannel AKP was run in order to study the behavior of the vector offweight coefficients and the square of error during automatic control in feedback circuits. A program of generation of a stationary normal random process was used as the noise signal source. Figures 3; references: 2 Russian.

FET ANALOG SIGNAL DIVIDER

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian No 4, 1979 pp 62-66 manuscript received 6 Jul 78

ANTONOV, G. V., BORSHCHEVSKIY, A. I. and GUREVICH, I. V.

[Abstract] Parametric dividers (DU) have recently appeared in addition to traditional dividers which have a re-multiplier in the feedback circuit of an operational amplifier and log-antilog conversion. In the present work a parametric DU is synthesized on the basis of mass-produced ICs. In a simple structure of a function generator (FP) which contains one variable amplifier (UU), the control voltage of UU is a linear function of voltage on the second input of the function generator. Tests showed that the

primary relative error is three percent and is due to the nonlinearity of the characteristic curve of FET control; additional temperature error is 0.1 percent per degree. The difference between the additional temperature error and its theoretical value is attributable to the lack of identity of FETs in the IC (up to 15 percent rated tolerance). The frequency range of DU is determined by the type of operational amplifiers (OU) used and their amplitude-frequency correction circuits, and constitutes 0-20 kHz at each input. The paper was recommended by the Department (Kafedra) of the Theory of Transmission of Signals and the Theory of Nonlinear Electrical Circuits, Leningrad Electrotechnical Institute of Communication imeni Prof. M. A. Bonch-Bruyevich.

Conferences

USSR

PROBLEMS IN CONSTRUCTING A PRIMARY LOCAL COMMUNICATIONS NETWORK

Moscow ELEKTROSVYAZ' in Russian No 1, Jan 79 p 63

MELIK-GAYKAZOVA, E.I.

[Abstract] An expanded visiting conference sponsored by the Scientific-Technical Society for Radio Engineering and Telecommunications imeni A. S. Popov was held in Odessa in August 1978. The conference was devoted to urgent questions in the design of primary local communications networks, which are the most capital intensive networks in the unified automated communications system, as well as related telecommunications traffic theory. The reports included the following: "Ways of Expanding Primary Intrazonal and Local Communications Networks Using Digital Transmission Systems," "Ways of Expanding a Data Transmission Network," "The Basic Design Principles of Modern Digital Transmission Systems Intended for the Expansion of Primary Communications Networks," "Problems with the Introduction of Electronic Switching Systems in Local Telephone Networks," and "Statistical Modeling and the Analysis of Network Structure." The significance of research underway at the Institute of Information Transmission Problems of the USSR Academy of Sciences in the field of three-layer modeling of a communications network and the development of the software for the analysis and synthesis of information networks are also noted.

USSR

UDC 621.372.061

USING DIRECTED GRAPHS IN ORDER TO CALCULATE THE STEADY-STATE OPERATION OF INVERTERS

Minsk IZV.VUZ: ENERGETIKA in Russian No 5, May 79 pp 37-43 manuscript received 24 Nov 78

ZHUYKOV, V. YA., candidate in technical sciences, KOROTEYEV, I. YE. and SUCHIK, V. YE., engineers

[Abstract] A method is proposed for calculating steady-state processes in inverter (Ventil'nyy preobrazovatel') circuits of variable structure based on using directed graphs without the need for comparing with the solution of a system of difference equations. The quantities to be determined can be found independently of one another. A clear picture of problem solutions is provided by a graph of the change in states. The high degree of algorithmization makes it easy to use digital computers to analyze high-order inverters. The paper was submitted by the Department (Kafedra) of Industrial Electronics, Kiev Order of Lenin Polytechnical Institute imeni the Fiftieth Anniversary of the Great October Socialist Revolution. Figures 3; references: 7 Russian.

USSR

UDC 62-83:62-523

THE SYNTHESIS AND STUDY OF ACTUATOR SYSTEMS FOR CONTROLLING A DIRECT CURRENT ELECTRIC DRIVE

Moscow IZV.VUZ: ELEKTROMEKHANIKA in Russian No 5, May 79 pp 407-413
manuscript received 27 Jan 77; after completion, 15 Jan 79

ZELENOV, ANATOLIY BORISOVICH, candidate in technical sciences, Assistant Professor (Dotsent), Kommunar'sk Mining and Metallurgical Institute

[Abstract] An actuator control system for positional direct current drives is proposed and analyzed, based on the following considerations: 1) The optimality criterion is a minimum of the integral mean square error; 2) The controlled object is linearized, which permits the simple realization of controller algorithms in phase coordinate functions; and 3) The controllers are actuators employed in a slip mode so that the very high gains provide for low system sensitivity to parametric disturbances. The proposed structural configuration of the control converter is characteristic of a) A DC generator with an electrical machine or magnetic amplifier and exciter, or with a rectifier type pulse width converter in the excitation circuit; and b) A rectifier type converter with phase control. The analytically derived optimum algorithms of the controllers which control the armature current, the angular travel and the speed are applied to the following specific cases: 1) A motor-generator system where the generator is excited by a dynamoelectric amplifier, the generator is a type PN-145, the motor is a PN-85 and the exciter is an EMU-100; 2) The same motor-generator system excited from a rectifier type pulse width converter; 3) An exciter-motor system with the MI-32 motor armature powered from a thyristor pulse width converter; 4) A motor-exciter system with the PN-85 motor armature powered from a PTTR-460-100 rectifier type converter with phase control; and 5) A mathematical model of the above controlled object [4] on an analog computer. The actuators employed for the above systems were a UU-2 electronic amplifier for 1) and 3), a magnetic amplifier with a supply frequency of 1.5 KHz for 2) and an IC operational amplifier for 4). The slip mode frequencies in hertz were found to be 12-20, 80-100, 600, 300 and 20,000, respectively. Oscilloscope traces are shown for some of the system responses. Figures 5; tables 1; references: 3 Russian.

PULSE-PHASE REMOTE CONTROL FROM A MOBILE UNIT USING A THREE-PHASE POWER SUPPLY LINE

Moscow IZV.VUZ: ELEKTROMEKHANIKA in Russian No 5, May 79 pp 457-458
manuscript received 26 Dec 78

BUROK, VALERIY STANISLAVOICH, candidate in technical sciences, Assistant Professor (Dotsent), Novochoerkassk Polytechnical Institute; and
VOVNICHENKO, VLADIMIR IVANOVICH, foreman (master), Taganrog Metallurgical Plant

[Abstract] For remote control from a moving unit, powered from three-phase mains, having mains receivers without a neutral wire, the system can be significantly simplified if the phase of the neutral sequence current is used as the information criterion. Such a remote control system is proposed where the command set consists of a phase controller with a switcher and resistor installed in the mobile unit and connected to the three-phase mains and the receiving complex through the power current connectors and a trolley. The three lines feeding the trolley form the primary windings of a current transformer, the secondary of which is connected to a driver supplying the neutral sequence pulses. Coincidence amplifiers, equal in number to the number of instructions, drive the actuating devices of the control objects. The system described has been successfully used for 3 years to control the covers of switchover doors of a heating furnace from a switchover machine in a pipe rolling shop, where the number of instructions is 12. This system can also be used to control the charging doors of open hearth furnaces from charging machines, the covers of pit furnaces from tong cranes, etc. The number of instructions can be increased to 24-30, where the factor limiting this increase is the total impedance angle variation in the neutral current circuit due to the variation in the length of the feed trolleys when the unit moves. Specifications are given for the components used in the system and oscilloscope traces of the relevant currents are shown to illustrate system operation. Figures 1; references: 3 Russian.

DESIGN CALCULATIONS OF THE MAGNETIC FIELDS IN THE COMMUTATION REGION OF
DIRECT CURRENT MACHINES WHEN POWERED FROM DIRECT CURRENT AND PULSATING
VOLTAGE SOURCES

Moscow IZV.VUZ: ELEKTROMEKHANIKA in Russian No 5, May 79 pp 425-430 manu-
script received 13 Jun 77; after completion, 10 Jul 78

SKOROSPESHKIN, ALEKSEY IVANOVICH, dr in technical sciences, Professor
Kubyshev Polytechnical Institute (KPI); CHEBOTKON, EDUARD GALAKTIONOBICH,
candidate in technical sciences, Assistant Professor (Dotsent), KPI;
PRUDNIKOV, VITALIY ALEKSEYEVICH, candidate in technical sciences, Assistant
Professor (Dotsent), KPI; and TROSHIN, VALENTIN VASILEVICH, graduate
student, KPI

[Abstract] A mathematical model is derived which permits the determination
of the induction in the air gap of low and intermediate power DC machines
due to the fields of the main and supplemental poles and the armature reac-
tion field. Polynomial expressions for these fields suitable for digital
computer use are derived and good agreement is found between experimentally
determined and calculated curves for the distribution of the induction in
the commutation region of P31 DC motor. The program which was compiled for
the BESM-4M digital computer provides for plotting the regions of spark free
DC motor operation as a function of the dimensions of the magnetic circuit
components. That combination of the width of the additional pole piece,
the air gap beneath the additional and main poles and the pole overlap fac-
tor which corresponded to the maximum commutation stability was found by
means of rearranging the variables in the derived expression in a specific
sequence. The mathematical models also allow for the solution of the prob-
lem of determining the dimensions of the magnetic circuit components from a
known curve for the induction distribution in the air gap beneath the sup-
plemental pole. The expressions apply to both DC and pulsating voltage
sources and the magnetic field model can be used to develop a unified system
for the automatic design of DC commutating machines. Figures 3; references:
7 Russian.

ON A METHOD FOR THE EXPERIMENTAL DETERMINATION OF THE CHARACTERISTICS OF AN
ELECTROMAGNETIC SUPPORT

Moscow IZV.VUZ: ELEKTROMEKHANIKA in Russian No 5, May 79 pp 436-441 manu-
script received 9 Dec 77

VASIL'YEV, VLADIMIR SERGEYEVICH, engineer; and SERDYUK, GAY BORISOVICH,
candidate in technical sciences, Assistant Professor (Dotsent), Kiev
Polytechnical Institute

[Abstract] Two diametrically opposed electromagnets pulling against each other are used to suspend an object. Stabilization is achieved through the use of sensing windings which serve as displacement sensors, which drive a negative feedback amplifier controlling the electromagnet. A procedure is proposed for the experimental determination of the electromagnetic support characteristics, specifically; 1) The amplitude frequency response, which permits an assessment of the overload capability of the support for the case of vibrations; 2) The transient response of the system which makes it possible to assess the operational speed of the system; and 3) The static error which characterizes the precision with which the body is suspended in a specified position. Analytical expressions are derived for the amplitude of the perturbing voltage fed to the DC negative feedback amplifier input when determining the frequency response of the system. The proposed method was used in an experimental study of a magnetic support; the calculated and experimentally determined system frequency response show good agreement, where the characteristics are shown as the maximum amplitude of the vibrations of the support element as a function of frequency for a constant amplitude of the perturbing effect. The maximum vibrational amplitude is about 105 micrometers at 20 Hz. An oscilloscope trace of the transient response of the same system is also shown. The proposed procedure permits the determination of these characteristics of an electromagnetic support with an external stabilization system, where the suspension system does not have to be disassembled. Figures 4; references 7: 6 Russian, 1 Western.

USSR

UDC 621.315.616.9

INFLUENCE THAT CYCLIC APPLICATION OF VOLTAGE HAS ON FAILURE OF POLYETHYLENE INSULATION

Minsk IZV.VUZ: ENERGETIKA in Russian No 4, Apr 79 pp 19-24 manuscript received 9 Jun 78

LKHAMAZHAPOV, V. A., candidate in technical sciences, docent, and
LUBSANOV, A. A., engineer

[Abstract] An investigation is made of failures of polyethylene insulation with cyclic application of alternating and direct voltage. Tests were done on low-pressure polyethylene grade 204.06-007 with a melt index of 07. The studies were done in a two-cylinder electrode system. The electric field strength was 35 kV/mm for the alternating field, and 69 kV/mm for the DC field. It was found that the no-failure probability of polyethylene insulation with cyclic application of AC and DC voltage is described by Weibull's equation. The no-failure probability of polyethylene decreases with cyclic application of DC voltage as compared with continuous voltage. The service life of the insulation shows an even sharper drop when the DC voltage is applied in cycles with a change in the polarity of the electric field after

each cycle. It is suggested that the reduction in service life of polyethylene is associated with polarization. The paper was submitted by the Department (Kafedra) of Power Supply of Industrial Enterprises, East-Siberian Technological Institute. Figures 4; references: 6 Russian.

USSR

UDC 681.84.081.42.089.6

A DEVICE FOR RECORDING AND PLAYBACK OF ACOUSTIC EMISSION SIGNALS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 79 pp 39-41

GRESHNIKOV, V. A. and BRAGINSKIY, A. P.

[Abstract] A device is described for recording and playback of acoustic emission signals used in nondestructive quality control. The device is based on a modified Elektronika-501-video tape recorder. The recording channel operates in a range of 50-1000 kHz with a sensitivity of $1 \mu V$, gain of 60 dB, dynamic range of 40 dB, nonuniformity of amplitude-frequency response of no more than 3 dB, and coefficient of nonlinear distortions of no more than 3 percent. The unit satisfies requirements of repeated playback of both the signal and its statistical characteristics with a high degree of repeatability. In acoustic emission studies, the device can isolate and record all information on acoustic emission signals, store it for long periods, and use it repeatedly for different methods of analysis. Figures 3; tables 1; references: 2 Russian.

USSR

UDC 538.574.6

NUMERICAL ANALYSIS OF DIFFRACTION OF ELECTROMAGNETIC WAVES BY AN OPEN
CIRCULAR CYLINDRICAL SURFACE

Gor'kiy IZV.VUZ: RADIOFIZIKA in Russian Vol 22, No 5, 1979 pp 620-627
manuscript received 6 Dec 77; after revision, 26 Oct 78

ZAKHAROV, YE. V. and PIMENOV, YU. V., Moscow State University

[Abstract] In a previous paper, these authors proposed a method for solving two-dimensional problems of diffraction of electromagnetic waves on ideally conductive open cylindrical surfaces of arbitrary shape [see "Radiotekhnika i elektronika," Vol 22, No 4, 1977, p 678]. The method is based on reducing the problem to strict Fredholm's integral equations of the first kind for the density of currents induced on the surface, and subsequent numerical solution of the resultant integral equations by a method of self-regularization [see V. I. Dmitriyev, Ye. V. Zakharov, in the book: "Vychislitel'nyye metody i programmirovaniye," Moscow State University, 1968, p 10]. In this paper, the method is used to solve the two-dimensional problem of diffraction of harmonic electromagnetic waves (time dependence $e^{i\omega t}$) by an ideally conductive open cylindrical surface. An analysis is made of the scattering diagrams of such a surface excited by E- or H-polarized waves. The results are compared with the corresponding relations for a circular cylinder and a strip. Figures 8, references 10: 9 Russian, 1 Western.

USSR

UDC 538.574.2

CONCERNING A PECULIARITY OF REFLECTION OF ELECTROMAGNETIC PULSES BY A
CONDUCTIVE MEDIUM IN NONUNIFORM MOTION

Gor'kiy IZV.VUZ: RADIOFIZIKA in Russian Vol 22, No 5, 1979 pp 639-641
manuscript received 21 Jun 78

GAVRILENKO, V. G., ZELEKSON, L. A. and LUPANOV, G. A. [deceased]. Gor'kiy State University

[Abstract] An examination is made of the problem of interaction between an electromagnetic pulse and a jet of conductive fluid with a dielectric constant much greater than unity, and given a longitudinal distribution of conductivity moving at a velocity much smaller than the speed of light, but comparable with the phase velocity of the incident electromagnetic wave. It is shown that under certain conditions the transmitted and reflected waves may be amplified, and that monochromatic lines may arise in the spectrum of

the reflected signal when the pulse excites stationary natural oscillations in the jet. References: 4 Russian.

USSR

UDC 621.371

RADIATION CHARACTERISTICS OF VEGETATIVE GROUND COVER IN THE MICROWAVE BAND

Moscow RADIOTEKHNIKA in Russian Vol 34, No 5, May 79 pp 16-24 manuscript received 25 Oct 78

BASHARINOV, A. YE. [deceased] , ZOTOVA, YE. N., NAUMOV, M. I. and CHUKHLANTSEV, A. A.

[Abstract] The paper gives theoretical and experimental data on the problem of determining propagation and scattering of microwaves in vegetation. Theoretical models are considered in which the vegetative ground cover is treated as a continuous medium (where the distances between scattering elements of the vegetation can be taken as small compared with a wavelength), and with consideration of the ground cover as a set of scatterers at distances between the elements of adjacent plants that exceed a wavelength. A model is also examined for the ground cover and the underlying surface considered as a single system. Experimental data are given that show the feasibility of using microwave measurements of radiation characteristics to determine the state of agricultural crops, and also for inventory purposes. Figures 4; tables 3; references 26: 12 Russian, 14 Western.

USSR

UDC 621.317.335.3

INVESTIGATION OF THE DIELECTRIC PROPERTIES OF GROUND COVERS ON MILLIMETER WAVES

Moscow RADIOTEKHNIKA in Russian Vol 34, No 5, May 79 pp 84-85 manuscript received 21 Dec 78

ANDREYEV, G.A., MERIAKRI, V. V., RUBTSOV, S. N. and USHATKIN, YE. F.

[Abstract] Data are given on the dielectric constants of ground covers in the two-millimeter waveband: asphalt, concrete, soil, sand, snow, red brick, silicate brick, pine woods and glass. It was found that asphalt and concrete have high absorption (15-17 dB/cm) in the 2-mm band, while snow has low absorption (0.9 dB/cm). Concrete is also a strongly refracting ground cover. Temperature has a considerable effect on the imaginary part of complex permittivity in soil and snow, but little influence on the real part. The authors thank V. A. Timofeyev for assistance in making specimens. Figures 3; tables 1; references: 4 Russian.

USSR

UDC 537.533.2:537.525.2

THE INFLUENCE OF AN EXTERNAL ELECTRICAL FIELD ON ELECTRON EMISSION FROM
DISPERSED FILMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79 pp 823-828 manuscript received 3 Feb 78

VIDUMA, L. V. and KULYUPIN, YU. A.

[Abstract] Emitters based on dispersed molybdenum films were prepared by thermal evaporation at a residual gas pressure of 10^{-8} torr, where a glass plate with a conducting coating was used as the anode, the gap between which and the film cathode was approximately 200 micrometers. The authors were compelled to introduce rather large specific powers (10^5 -- 10^7 w/cm³) into the film in order to obtain large emission currents and to prevent the activating coating from reducing the work function. The emission current is plotted as a function of the anode voltage at various voltages across the film, and estimates of the electron temperature of the emission centers are made on the basis of the resulting functions of the form: $\ln(I_e) = f(V_a^{1/2})$. The literature shows that an emission center can have linear dimensions on the order of 10^{-5} cm, and if there are 10^2 emission centers in the film, their surface will be on the order of 10^{-7} cm². To obtain an emission current of $4 \cdot 10^{-7}$ a in the case where the work function is approximately 4.4 eV, it is necessary that the electron temperature be about 2,600°K; this temperature and these currents were obtained by the authors at $U = 95$ v, with appropriate allowances for a variation in the geometric form factor based on the plane capacitor model. It is shown that the complex nature of the electron emission current as a function of the external field can be understood on the basis of concepts of electron gas heating in the film. The electron emission current has no true saturation level, and when the electrical field at the emitter surface increases in a range of 10^4 -- 10^5 v/cm, it continually increases, something which is characteristic of the emission of hot electrons. Figures 6; references 9: 6 Russian, 3 Western.

USSR

UDC 621.385.001.69

ON NOISE-LIKE SIGNAL AMPLIFICATION IN AN M-TYPE TRAVELING-WAVE TUBE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79 pp 865-866 manuscript received 4 Jul 77

ZHELEZOVSKIY, B. YE. and ZHELEZOVSKIY, YE. YE.

[Abstract] Using a procedure described in previous literature, an adiabatic approximation of a fine electron beam is employed in a numerical analysis of the power design parameters of M-type TWT's. The effect of space charge forces is neglected. The electron flux is density modulated by a white noise-like signal, simulated by ten spectral components with random phases uniformly distributed in a range of -180° to $+180^\circ$ and with amplitudes, taken with a coefficient of 0.04 from a set of normal random numbers. The gain was calculated for 10 realizations in operational modes described in earlier literature. The distribution of the total RF power over the length of the interaction space and averaged over the 10 realizations, where this distribution is the mean square power characteristic of the process is graphically plotted. Also shown in the same plot is the distribution over the length of the interaction space of the averaged noise-like signal power which acts at the input of the interacting system with the same set of random numbers used to specify the amplitude of the RF fields. A third curve is plotted showing the distribution of the RF power of the harmonic signal acting at the input of the interacting system, something which permits an evaluation of the TWT gain. It follows from the qualitative analysis of the curves that: 1) With noise-like modulation of the electron flow, the specified output power levels can be obtained even at small lengths of the interaction space; 2) The amount of the output power in the regions of substantial nonlinearity confirms the conclusion of the good power design capabilities of these TWT's when amplifying noise-like signals; and 3) In the range of interaction space lengths of practical interest, the total mean power of the stochastic process at the output of the TWT is less than the harmonic signal output power and only approaches it at considerable interaction space lengths (at current deposition factor levels exceeding 70 percent). This latter conclusion contradicts the results published by Scherba and Rowe (IEEE TRANS, 1971, ED-18,1,11). The authors of the present paper attribute the problem with the Scherba-Rowe work to possible imprecision in the measurements or in the generation of the noise signal. Also, the nature of their results can be due to the specific features of the measurements, in particular, the design and type of power meters employed. Figures 1; references 4: 2 Russian, 2 Western.

ON THE THEORY OF AN M-TYPE TRAVELING-WAVE TUBE CONVERTER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79
pp 869-871 manuscript received 21 Jul 77

ZHELEZOVSKIY, B. YE. and KOZEL', B. I.

[Abstract] The amplification of two and more signals in electron beam devices is accompanied by interactions between the electrons in the beams and the waves in the interaction system, which can lead to frequency conversion with the simultaneous amplification of the converted signal even if its frequency does not fall in the effective gain passband of the RF signals fed to the input. In the present work a mathematical model of M-type devices in the form of a system of differential equations, the parameters of which play the part of factors, is numerically analyzed. A planned experiment is conducted using a Hartley plan from a class close to the D-optimal for the selected factors; this plan made it possible to formulate both linear and nonlinear models by increasing the number of trials (solutions of the system of equations), where the maximum number of trials was 27. It is found that the numerical and analytical calculations are in good qualitative and quantitative agreement. However, the analytical form of the equations derived using the proposed analysis procedure is much more convenient for estimating the characteristics of an M-type TWT converter. Figures 2; references: 6 Russian.

DETERMINATION OF THE MOMENT OF THE FORCES ACTING ON FIBERS OF DIFFERENT CONDUCTIVITY IN A STRONG ELECTROSTATIC FIELD

Moscow ELEKTRICHESTVO in Russian No 1, Jan '79 pp 58-61 manuscript received 9 Jan 78

HERSHEV, YE. N., SEMENOV, V. A. and SHAGLIN, G. P., Leningrad

[Abstract] Natural and synthetic fibers, in the shape of a thin cylinder, are used in the production of electroflocculated synthetic materials such as suede and fir. The fibers are polarized in an electrical field and acquire an electric moment because of the shift of the bound and free charges. The orientation of the fibers in the field is determined to a significant extent by the moment of the electrical forces. The higher the conductivity of the fibers, the greater the moment acting on them caused by the electrical field, and the more stable their orientation is along the field lines of force. The fiber material is a good dielectric as a rule, and to increase the control, the fibers are chemically treated so as to create an extremely thin coating of greater conductivity on them. The higher the conductivity of this surface layer, the better the quality of the chemical treatment of the fibers. This paper resolves the question of to what extent the moments differ which act on pure chemically treated fibers and ideally conducting fibers of the same shape. Three groups of fibers with lengths of $2 \cdot 10^{-3}$ m and diameters of $6 \cdot 10^{-5}$ m were studied experimentally: 1) Capron fibers washed in carbon tetrachloride, with a resistance of $R = (4.2 \pm 0.2) \cdot 10^8$ ohms at an air temperature of 18° and humidity of 65 percent; 2) Capron fibers subjected to a different chemical process, with a resistance of $(3.5 \pm 0.2) \cdot 10^7$ ohms; and 3) Segments of copper wire. The electrical field intensity was $5 \cdot 10^5$ v/m and the motion of 36 fibers was determined by a SKS-1M slow motion camera running at a rate of from 2,000 to 4,000 frames per second. Analytical expressions are derived for the moments and compared with experimentally determined values. Good agreement was found: a figure of $4.05 \cdot 10^{-9}$ N · m was computed for the metal fibers as compared to an experimentally determined value of $(3.9 \pm 1.4) \cdot 10^{-9}$ N · m. Similar values were obtained for chemically processed fibers and the experimental procedures determined which of the treatment processes found in the literature [USSR Patent 476350] provides the greatest increase in the moments acting on Capron fibers in a strong electrostatic field (an increase of more than an order of magnitude). Conversion formulas are derived in two appendices for a thin metal cylinder and a thin dielectric cylinder. Figures 4; references 7: 5 Russian, 2 Western.

USSR

UDC 621.391.266

ESTIMATION OF A CONTINUOUS SIGNAL ACCORDING TO THE MEDIAN OF ITS A
POSTERIORI DENSITY

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian No 4, 1979 pp 8-10
manuscript received 18 Sep 78

KLOCHKO, V. K.

[Abstract] Situations are often encountered in technical measurements where a signal, constant during the observation period and distorted by uncorrelated noise, must be estimated. The case where s (the true value of the signal) is random in a large number of realizations and takes on some value in conformity with a known distribution density $\sigma(s)$ is investigated. The procedure for estimating the parameter s should be done in two stages: 1) Find the sample average of all measurements by averaging observed values; and 2) Compute an estimate of $s(v)$ on the basis of v . Relationships derived show that the probability that an estimate error in terms of the median is less than the error of any comparable estimate is always greater than 50 percent. The paper was recommended by the Department (Kafedra) of Automatics and Telemechanics, Ryazan Radio Engineering Institute. Figures 2; references: 2 Russian.

USSR

UDC 531.781.2:621.382

ON THE AMPLITUDE-FREQUENCY CHARACTERISTICS OF PASTED SEMICONDUCTOR STRAIN
GAGES

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian No 4, 1979 pp 58-61
manuscript received 4 May 78

ABRAMCHUK, G. A.

[Abstract] The study of the dynamic properties of solids by the strain gage method covers a comparatively wide range of exposure time and deformation amplitudes, which permits calculation of the relaxation spectrum in order fully to describe the behavior of solids in deformation waves. The results of this research and their reliability are generally determined by the dynamic performance of pasted (Nakleenykh) semiconductor strain gages (NPT): this is important in estimating the magnitude and nature of distortion introduced by NPTs into the wave processes being studied. NPT are considered to be measuring transducers with distributed parameters. In a quasilinear approximation, and under the condition that the adhesive has no noticeable effect on the solid through which an elastic deformation wave is being propagated, the displacement of points of the adhesive toward the strain-sensing

element of the strain gage (TET) is described by a partial differential equation. Theoretical findings agree well with experimental results described by the author in an earlier work. The use of the amplitude-frequency characteristic of NPT will facilitate the solution of a wide range of applied problems. The paper was recommended by the Department (Kafedra) of Semiconductor Electronics, L'vov Polytechnical Institute. Figures 1; references: 3 Russian.

USSR

UDC 621.317.78

MICROWAVE POWER METER BASED ON HALL-EFFECT

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 5, 1979 pp 79-80 manuscript received 15 May 78

GASHKA, K. and REPSHAS, K.

[Abstract] A connection was established for semiconductors between the average cyclic ponderomotive force F_c and the average Hall cyclic electrodynamic force: $\bar{V}_H = k_{HC} F_c$, where k_{HC} is the Hall coefficient. Because force acts only on free charge-carriers, Hall e.d.f. is not sensitive to mechanical noise and measurement of absolute power using the Hall effect should find wider application. If, simultaneous with microwave power, a semiconductor is affected by a continuous electrical and magnetic field of such polarity and magnitude that the Hall e.d.f. generated by these fields is equal in magnitude and of an opposing sign to Hall e.d.f., then the microwave power density $\Pi = E_0 H_0$. Semiconductor parameters do not enter here, and the absolute value of microwave density can easily be determined according to measured values of E_0 and H_0 . Consequently, the magnitude of power density defined by the last equation should be independent of the temperature of the Hall sensor. The Hall sensor was made of n-type silicon with ohmic contacts; it was mounted in a waveguide $23 \times 10 \text{ mm}^2$ in cross section which was placed in a continuous magnetic field of 0.1 tesla. The continuous electrical field in the sensor was generated by a direct-current source. Pulsed modulation of the microwave carrier was utilized. An SI-17 oscilloscope served as the zero display. Density of power determined from measured values of E_0 and H_0 was kept constant. Since E_0 and H_0 are easily measured, it is possible to use this method to measure both pulsed and continuous microwave power. Figures 2; references 3: 2 Russian, 1 Western.

MASTER EQUIPMENT FOR CHECKING INFRALOW-FREQUENCY PHASE METERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 79 pp 43-45

DANILOV, R. P., GURCHIS, V. V., KRAVCHENKO, S. A. and ANEPIR, A. A.

[Abstract] The article describes a master instrument for checking infralow-frequency phase meters. The device has a measurement error of less than $0.1-0.3^\circ$ in a range of $0-360^\circ$. It is based on a technique of double frequency conversion in a two-channel system with phase monitoring by the series-produced F2-13 phase meter and rapid setting of phase ratios by the second harmonic method [S. A. Kravchenko, USSR Author's Certificate No 216141, "Byulleten' izobreteniy," 1969, No 9]. The block diagram of the facility is described, and an example is given illustrating use of the equipment to check NF-3M phase meters. The facility can be used in conjunction with the F1-2 phase calibrator to check NF-2, NF-3 and NF-3M phase meters in the frequency range of 0.001-100 Hz with error of 0.25° , and to check F2-1, F2-4, F2-13 and F2-16 phase meters in the frequency range of 20-1000 Hz with error of 0.15° when readings are taken from the scale of a calibrated phase shifter, and within 0.03° when the F2-13 phase meter is used in the mode of increments in the phase shift angle. Figures 1; references 4: 3 Russian, 1 Western.

SPECIFICS OF DESIGNING FLIP-FLOP COMPARATORS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 79 pp 47-49

BRYAKIN, L. A., VASHKEVICH, N. P. and GOVOROV, V. F.

[Abstract] Relations are presented for evaluating hysteresis and initial zero displacement reduced to the input, delay time and aperture of synchronous and asynchronous flip-flop comparators. It is shown that regardless of the parameters of the elements in the comparator, hysteresis can be reduced to zero by proper selection of the collector current of the transistors, and the bias voltage can be reduced to zero by changing the ratio between the resistances in the collector circuits of the transistors. An experimental check showed total hysteresis and zero displacement of no more than 1 mV, and the aperture (about 20 ns) and delay time (about 30-35 ns) were close to the calculated values. Figures 2; references: 6 Russian.

USING SEMICONDUCTOR DISKS TO MEASURE MICROWAVE POWER

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 79 pp 49-50

KOMOV, A. N. and KUDRYAKOV, YU. P.

[Abstract] An investigation is made of magnetoresistive microwave power meters based on semiconductor transducers in the form of disks with two point contacts located close to the center of the disk. These devices can be used to measure microwave power at intermediate and low levels. The paper describes the technique used in making n-InSb disks 5.0 mm in diameter and 150-180 μ m thick. Pure tin non-rectifying point contacts were symmetrically located close to the center of the disk. The sensor was placed on a mica backing and fastened in a microwave measurement head in the form of a section of waveguide with a cross section of 23 x 10 mm. The plane of the disk was parallel to the narrow wall of the waveguide, and the distance between them could be varied. The signal from the transducer was coupled out through ports in the wide walls of the waveguide into wires. The conversion factor of the instrument is nearly independent of frequency, and changes by only 5 percent in a range of 9.5-11.0 GHz. The temperature dependence of readings can be minimized by appropriate choice of semiconductor material. Operation of the instrument is practically independent of external electric fields because of the shielding provided by the waveguide. Figures 3; references 8: 3 Russian, 5 Western.

IMPROVING ACCURACY OF rf PERMEABILITY MEASUREMENT

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 79 pp 51-52

ZIMA, A. A. and CHERNOUSOVA, N. N.

[Abstract] A method is proposed for using inductance standards to improve accuracy in rf permeability measurement. Certification of permeability reference specimens for checking magnetodielectrics and ferrites in a range of 1-200 MHz is done by an indirect method involving determination of the impedance components introduced by the test specimen. The resultant error is 1-3 percent. It is recommended that this error be reduced by using specially developed inductance standards to certify master measurement facilities with respect to the inductance introduced by the reference specimen in the measurement circuit. A set of such standards is described that was developed by the Siberian Scientific-Research Institute of Metrology. The set includes eight short-circuited coaxial line sections with wave impedance of 50 Ω in lengths ranging from 2.5 to 20 cm, which corresponds

to inductances from 4 to 35 nH. An analysis is made of the errors resulting from use of these standards to certify master instruments to measure permeability on radio frequencies. It is shown that the unavoidable systematic error is 0.1 percent, and the standard deviation is 0.06 percent. Figures 1; references: 6 Russian.

USSR

UDC 621.372.001.24:681.3

A METHOD OF CALCULATING THE NONSTEADY-STATE TEMPERATURE FIELDS OF SEMI-CONDUCTOR MICROCIRCUITS

Moscow IZV.VUZ: RADIOELEKTRONIKA in Russian Vol 22, No 6, Jun 79 pp 77-81
manuscript received 14 Aug 78, after completion, 4 Dec 78

ZAKS, D. I. and MADERA, A. G.

[Abstract] Analytical formulas are derived for the calculation of the three-dimensional, nonsteady-state temperature fields of a multilayer parallelepiped with the local action of power pulses of any width and waveform. The end faces of the parallelepiped are assumed to be insulated and the model is sufficiently precise for the heat transfer processes in integrated circuits where the end face surfaces are less than the horizontal surfaces. The heat propagation is described by a system of partial differential equations which are reduced to finite difference form and then written in matrix form using Laplace transforms. The derived formula contains time in explicit form and permits the determination of the nonsteady-state temperature fields as a function of time and coordinates. Because of the complexity and diversity of actual microcircuit configurations, a theoretically adequately precise estimate of the error arising from the deviation of the thermal model from the actual device is not possible. The treatment of such questions in the literature indicates that the error of the design procedure, including the inaccurate specification of the initial data, does not exceed 20 to 25 percent. Figures 1; references: 11 Russian.

USSR

UDC 621.373.072.9

PARAMETERS OF AN AVALANCHE DIODE OSCILLATOR IN THE MODE OF SYNCHRONIZATION BY A HIGH-LEVEL HARMONIC SIGNAL

Moscow RADIOTEKHNIKA in Russian Vol 34, No 5, May 79 pp 50-51 manuscript received 13 Feb 78

PONOMAREV, L. I., YEL'TSOV, A. K. and LIKHODED, YU. V.

[Abstract] An examination is made of the working conditions of an avalanche diode oscillator with synchronization by a harmonic signal with power comparable to the output power of the oscillator. The analysis is based on experimental amplitude-frequency and phase-frequency responses of a series-produced avalanche diode oscillator in the centimeter waveband. A phase bridge was used for the measurements. It was found that the power of the oscillator output signal varies by no more than 20 percent with a change in synchrosignal level from 0 to -7 dB. In case of maximum oscillator power, the phase of the output signal changes from 0 to 30° when the synchrosignal level changes from 0 to -7 dB, and at half-maximum power, the phase remains nearly constant as the synchrosignal level varies. These oscillators should be useful in electronic communication systems and phased antenna arrays. Figures 5; references:2 Russian.

USSR

UDC 621.319.53

MODELING THE PROCESS OF DISCHARGE OF A PULSED VOLTAGE GENERATOR

Minsk IZV.VUZ: ENERGETIKA in Russian No 5, May 79 pp 21-25 manuscript received 28 Jun 78

IL'YENKO, O. S., candidate in technical sciences, and KHATAYEVICH, YE. M., engineer, Kiev Order of Lenin Polytechnical Institute imeni the Fiftieth Anniversary of the Great October Socialist Revolution

[Abstract] An analysis is made of the process of discharge of a pulsed voltage generator based on an equivalent circuit that is described by a sixth-order differential equation. Analysis of the transient process reduces to solution of a system of differential and algebraic equations. Two methods are proposed for solving this system: by modeling on an analog computer, and by using a digital computer to solve the sixth-order differential equation corresponding to the system. A block diagram is given showing the model of the discharge process on an analog computer. The analog method is recommended for preselecting the parameters of the discharge circuit to get a required waveshape. The digital computer method gives high

accuracy, enabling analysis of aperiodic and oscillatory components of the output waveshape of the pulsed voltage generator. Figures 2, references:2: 1 Russian, 1 Western.

USSR

UDC 621.315.1

THE ELECTRICAL STRENGTH OF THE OPEN AIR INSULATION OF SUBSTATIONS AT SWITCHING OVERVOLTAGES

Moscow ELEKTRICHESTO in Russian No 1, Jan 79 pp 23-31 manuscript received 16 Jan 78

ALEKSANDROV, G. N., dr in technical sciences and GERASIMOV, YU. A., candidate in technical sciences, Leningrad Polytechnical Institute imeni M. I. Kalinin

[Abstract] A full-scale open test site was employed in order to study the breakdown strength of three insulation configurations: 1) Three shields to ground, as the equivalent of the insulation system between the equipment shields of adjacent phases; 2) Three wires to ground, as the equivalent of the lower tier of the buswork of a substation (discharges to equipment); and 3) Three wires to portal, as the equivalent of the upper tiers of substation buswork. The test facility provided two 2.25 MV transformer stages and a 3 MV pulse generator. When the test transformer stages were driven from oscillatory networks, voltage pulses were obtained with a rise time of the first half period of 3,000 microseconds, and with a rise time of 400 microseconds from the pulse generator. The test pulses were fed to the electrodes either synchronously or shifted in time. In the latter case, the shift was read from an oscilloscope trace. Detailed results are presented in tabular form for each of the three configurations, specifying the dimensions, the overvoltage levels and a variation parameter. No difference was found in the electrical strength characteristics for positive voltage pulse rise times of 400 and 3,000 microseconds, something which permits recommending the resulting experimental data for use in the selection of insulation spacings at substations. The influence of the third phase and the voltage on it on the electrical strength of three-phase insulation systems within a range of 10 percent was confirmed. The electrical strength of the shield--shield--ground system is markedly lower than that of the conductor--conductor--ground system. Similarity conditions were ascertained for three-phase insulation systems of substations, something which allows the generalization of all of the experimental data, regardless of the insulation spacings. This makes it theoretically possible to simulate the insulation systems of substations in tests. Figures 9; tables 3; references 6: 3 Russian, 3 Western.

ATMOSPHERIC OVERVOLTAGES AT STEPDOWN 6-10 KV SUBSTATIONS AND THEIR LIGHTNING PROTECTION

Moscow ELEKTRICHESTVO in Russian No 1, Jan 79 pp 62-64 manuscript received 17 May 78

KARAPETYAN, M. M., candidate in technical sciences and VARTAZARYAN, V.G., engineer, Yerevan

[Abstract] Overvoltage protection recommendations for 6-10 KV substations are developed on the basis of experimental studies of both mobile power plants and permanent substations. The following were used in the trials: a TSMA-180/10-0.4 power transformer; KShEP-4x10 mm², 0.5 KV flexible cable and KRPT-3x25, 1x10 mm², 142 m long; and GTSh-3x25 mm², 10 KV shielded cable, 85 m long. The 10 KV open-wire lines were replaced by their characteristic impedances of 250 ohms and the 120 m long entrances by an inductance of 0.1 mH. An A81-8A, 220/380 volts, 20 KW, 730 r.p.m. was used as the mobile generator. The grounding resistance of the machine was taken as 25, 50 and 75 ohms and the inductance of the KShEP cable wound on a metal drum (72 turns) was taken as 0.96 mH. Semiconductor models of the nonlinear resistance and expulsion type 10 KV arresters were used. It was found that the lightning protection of a 6-10/0.4 KV mobile station connected directly to a 6-10 KV open wire line should have RVP 6-10 and RVN-0.5 nonlinear resistance arresters installed between the entrances and the frame of the transformer and a protected entrance to the substation should be provided with one set of RTF or RTV 6-10 KV expulsion type arresters with a grounding resistance of 10-20 ohms. In this case, protective capacitors of 0.2 microfarads inserted at the end of the cable between the "working" and the "neutral" cores are used to protect the engines of the mobile unit. For permanent 6-10/0.4 KV substations connected directly to open wire lines, lightning protection of the transformer uses the same configuration without a protected entrance. When a mobile unit is connected to the openwire line through an armored or shielded cable, it is necessary to install nonlinear resistance arresters (RVP 6-10 KV) at both ends of the shielded cable and RVN-0.5 arresters between the low-voltage windings and the transformer frame. Equivalent circuits of these configurations are shown and overvoltage data for the various arresters are presented in tabular form. Figures 2; tables 2; references: 7 Russian.

PHYSICAL MODELING OF A CAPACITIVE POWER TAKE-OFF UNIT WITH DISTRIBUTED PARAMETERS

Minsk IZV.VUZ: ENERGETIKA in Russian No 4, Apr 79 pp 8-13 manuscript received 12 Dec 78

FEDOROVA, I. A., dr in technical sciences, Professor, and NAZARENKO, L. P.

[Abstract] An analysis is made of a physical model of an antenna power take-off system for high-voltage polyphase transmission lines. The three-phase power source is simulated by a master generator that feeds three phase-sequencing networks, and an aluminum strip is used to model the earth. Above the strip are six wires: three connected to the three-phase source to simulate the transmission line, and three parallel wires beneath these to simulate the antennas of the power take-off system. It is shown that the major factors that limit the frequency bands of power sources in such physical models are the harmonic components of the industrial frequency on the low side, and the input impedance of measuring instruments on the high side. A technique is proposed for calculating the resonant transfer element that enables determination of equivalent parameters of an antenna power take-off unit. The proposed high-frequency model is used to study the influence that design has on the characteristics of a three-phase antenna power take-off system. The paper was submitted by the Department (Kafedra) of Electrical Systems, Belorussian Order of the Red Banner of Labor Polytechnical Institute. Figures 3; references: 5 Russian.

USING DEVICES FOR LONGITUDINAL COMPENSATION OF VOLTAGE LOSSES TO IMPROVE THE VOLTAGE QUALITY OF 6 kV UNDERGROUND DISTRIBUTION NETWORKS IN POTASSIUM MINES

Minsk IZV.VUZ: ENERGETIKA in Russian No 4, Apr 79 pp 32-36 manuscript received 26 Sep 78

IVANOV, O. V., candidate in technical sciences, docent, KONOVALOV, B. P., candidate in technical sciences, NEFEDOVA, N. V., engineer, PROSKURYAKOV, YE. M., candidate in technical sciences, docent, and TRANDOFILOV, YE. S., engineer.

[Abstract] An examination is made of the problems involved in introducing facilities for longitudinal capacitive compensation of voltage losses in a 6 kV underground distribution network in a potassium mine. The compensating unit has a reactive power of 1600 kvar, and handles a power of 6500 kVA.

Sixteen months of operation in the second mine of the Beloruskaliy Production Association has shown that these units are operationally reliable. Installation of compensating units cuts down outages of electric motors, and improves the voltage quality at the terminals of the distribution points in mining sections, thus increasing productivity by stabilizing the operation of mining and transport equipment. Further studies are needed on choosing the optimum version of local voltage regulation in 660 V networks in mine sections more than 6 km distant. The annual economic effect from installing four longitudinal capacitive voltage loss compensation units is 160,000 rubles. The paper was submitted by the Department (Kafedra) of the Theoretical Basis of Electrical Engineering, Leningrad Mining Institute imeni G. V. Plekhanov. Figures 2; tables 1.

USSR

UDC 681.142.33:621.315

MATHEMATICAL MODEL OF THE CONNECTION BETWEEN DC TRANSMISSION AND AC ELECTRIC POWER SYSTEMS

Minsk IKV.VUZ: ENERGETIKA in Russian No 4, Apr 79 pp 95-98 manuscript received 16 Nov 78

VAKAFINA, L. A., KUZOVENKOVA, L. F. and FIMENOVA, YE. I., engineers

[Abstract] An examination is made of the problem of studying transient processes in a multiple-machine electric power system based on models in which rotating elements such as generators, motors and compensators are simulated by analog computer elements, while the static part of the system such as transmission lines, transformers and reactors is modeled by UMRES-2 substitution circuits using resistors, coils and capacitors. It is shown that the proposed technique can be used to simulate the system by which the analog model of a DC transmission system is connected to transmitting and receiving AC power systems in terms of the d-q coordinate axes fixed to the rotor of machines in the system by using equations for current transformation in the DC part of the system. The paper was submitted by the Scientific-Technical Council (NTS), Irkutsk Division of the All-Union Electrical Engineering Institute imeni V. I. Lenin. Figures 2; references: 4 Russian.

AN INVESTIGATION OF THE OPERATION OF DIRECT CURRENT TRANSFORMER AS TWO PHASE HIGH-POWER CONVERTERS

Moscow IZV.VUZ: ELEKTROMEKHANIKA in Russian No 5, May 79 pp 442-447
manuscript received 11 Apr 77

SHINKARENKO, GLEN VASIL'YEVICH, engineer, Donbass Power System; and
ALLILUYEV, ALEKSEY ANATOL'YEVICH, candidate in technical sciences, Assistant,
Novocherkassk Polytechnical Institute

[Abstract] The rectified current of a converter for the case of two-phase operation can be represented sufficiently precisely as the sum of a DC component and a sinusoidal component. A procedure is proposed for calculating the steady-state mode of a DC transformer, such as used in the protection circuits of high power bridge converters for high power DC transmission, where a sinusoidal component is present in the primary current. The derived analytical expressions were applied to the case of a TPT-300 DC power transformer to calculate the surges in the secondary transformer current, where this transformer is in service on the Volgograd-Donbass DC transmission line. The algorithm was run on a Mairi computer. The results of calculating the secondary current surges are shown graphically; the transformer parameters which prevent secondary current surges are specified and recommendations are given which assure the selective action of differential protective devices for the converters. Figures 4; references: 5 Russian.

USSR

UDC 621.391.8

INTENSITY OF THE FLOW OF POINTS OF INTERSECTION OF A THRESHOLD BY A RANDOM PULSED PROCESS

Moscow IZV. AKADEMI NAUK SSSR: TEKHNIЧЕСКАЯ КИБЕРНЕТИКА in Russian No 5, Sep/Oct 78 pp 206-209 manuscript received 29 Sep 75; after completion 9 Nov 76

VYAZEMSKIY, V. O., Leningrad

[Abstract] A study is presented of the method of calculation of the secondary flow (the flow of points of intersection) by means of the one-dimensional distribution of the process examined. The analysis includes the case when the initial flow consists of a super position of several independent flows. Several examples are analyzed of Poisson flows of pulses with constant length. Figures 1; references 2: 1 Russian, 1 Western.

USSR

UDC 519.24:621.374.101

THE CORRELATION FUNCTION OF A POISSON FLOW OF RECTANGULAR NONOVERLAPPING PULSES WITH FIXED LENGTH

Moscow IZV. AKADEMI NAUK SSSR: TEKHNIЧЕСКАЯ КИБЕРНЕТИКА in Russian No 5, Sep/Oct 78 pp 209-211, manuscript received 2 Mar 76; after completion, 20 Jan 77

ANTIPENKO, E. S. and FEOFANOV, G. N., Leningrad

[Abstract] In solving a number of problems, it is necessary to know the correlation function of a Poisson flow of fixed-length pulses with exponentially distributed pauses. Representing by A_k the event that the end of the Δ -section flow with identical pulse amplitude falls at the base of pulses with numbers other than k , the pulses are assigned the numbers 0 and k . The coordinate origin is shifted to the moment of appearance of pulse 0. Since the pulses do not overlap, no more than n pulses can be located between the ends of the Δ section. If $n = [\Delta/\tau]$ and $0 < \Delta < \tau$, only two incompatible results are possible: the Δ section is within the 0 pulse; or the section reaches from the 0 pulse to the first next pulse. This reduces the problem to calculation of a simple probability by integration of a linear equation. Figures 4; references: 2 Russian.

DIGITAL METHOD OF SYNTHESIS OF REFERENCE PULSE SEQUENCES

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian No 4, 1979 pp 3-7 manuscript received 8 Sep 78

YEFREMENKO, D. A. and MALEVICH, I. A.

[Abstract] With the development of statistical methods of investigation in experimental physics and methods of space-time isolation of maximally weak signals against a background of fluctuating noise in laser location problems, methods of precision synthesis of time scales phased by a flow of random signals and pulsed trains with discrete cyclic retuning has become very important. Current methods of discrete synthesis of time intervals can not be used to construct system of "cyclic" synthesis of pulse trains because of significant inertia and great "dead" time. A multiscalar regenerative principle of shaping a pulse train was developed using oscillators with multiple-loop delayed feedback: it consists of synthesis of a precision time interval with subsequent repeated regeneration of the synthesized interval. A pulsed recirculation oscillator with delayed feedback (GZOS) is utilized as the synthesizer's reference source. The discrete delay synthesizer consists of a decade divider (DPKD) with variable division factor ($K = 0-9999$) and open selection and control circuits. The digital method of synthesis of reference pulse trains produces a cyclic stability of said pulse trains which is weakly dependent on the magnitude of the interval synthesized. The time scale is easily calibrated and experimental verification of irregular onset of the time scale due to an overshoot of GZOS frequency is possible. The method is extremely useful in measuring and calibrating delay lines and studying phasing conditions and transient processes of phased oscillation sources. The paper was recommended by the Scientific-Research Institute of Applied Physics Problems, Belorussian State University imeni V. I. Lenin. Figures 4; references: 5 Russian.

USSR

UDC 621.397.331.2

ON THE CONSTRUCTION OF FRESNEL BINARY ZONE PLATES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79 pp 834-836 manuscript received 25 Jul 77

BAZARSKIY, O. V., KADASHOV, N. G. and KHLIVICH, YA. L.

[Abstract] The discrete realization of nonoptical holograms is usually accomplished in the form of binary transparencies, and while the binary rendering of an amplitude hologram boosts its diffraction efficiency to 10 percent, there is as yet no rule for this binary rendering of amplitudes holograms which provides for their maximum diffraction efficiency. The most useful procedure for generating binary holograms is the half-level interference picture section, while a more common is the rule for constructing binary holograms which takes into account the coordinates of the extrema of the interference picture, since a unique relationship between the section level and the coordinate is possible only in the case of equal intensity of the interference picture, something which is not observed when recording nonoptical holograms. This paper proposes a rule for the construction of these holograms which assures their maximum diffraction efficiency when recorded line by line. The special case of a rule for the construction of a Fresnel binary zone plate is analyzed, where this represents the hologram of a point source. Based on the analytically derived rule, it is shown that the requisite precision in the fabrication of the Fresnel plates or holograms should be on the order of one-tenth of a wavelength. Figures 2; references: 4 Russian.

USSR

UDC 621.373.853.08

OPTICALLY-PUMPED PULSED SUBMILLIMETER LASER USING CH_3Br AND CH_3Cl MOLECULES

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 5, 1979 pp 83-85 manuscript received 7 Feb 77

MANITA, D. F.

[Abstract] Chang and Bridges (Opt. Commun., 1970, 1, No 3, p 423) first reported on selective excitation of a purely rotary junction by means of optical pumping by a second laser. In this instance, a carbon dioxide laser with modulated Q, operating in the P(20) junction in the 9.6 micron region, was used to pump methyl fluoride. Further research revealed emission at the 21st new line in the range from 193 to 1800 microns in various molecules. There are now over 30 substances that can lase in the

centimeter range in a continuous mode with optical pumping by a carbon dioxide laser. This type of laser theory has not yet been sufficiently developed. Problems also arise in identifying the junctions of pumping and emission. The width of the generation line in some lines has reached 80 MHz. Measurements of generation divergence showed that 70 percent of all energy is contained in an angle of 3×10^{-3} radians. Effective conversion of pumping energy into the longer-wave infrared range, not yet mastered by powerful sources of coherent radiation, constituted 0.1 percent. Figures 3; tables 1; references: 3 Western.

USSR

UDC 621.396.96:621.391.26

ON THE CROSS AMBIGUITY FUNCTION OF A LINEAR FM SIGNAL FOR THE CASE OF A
RADAR RETURN FROM AN EXTENDED TARGET

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79 pp 751-
758 manuscript received 22 May 78

RUBTSOV, M. I. and CHETYRKIN, W. V.

[Abstract] A radar return from an extensive target can be treated in many cases as a random gaussian process with a zero mean value. Knowledge of the correlation function is sufficient for a complete description of this process; a formula is given for the correlation function of the return in the case of independent fluctuations of particle reflectors forming the extended target and a cross ambiguity function is defined in terms of this formula and then used as the characteristic of the random signal at the output of a regular linear filter of a receiver. This paper studies the influence on the cross ambiguity function of the radar characteristics of the extended target. A single linear FM pulse is used as the sounding signal. The conditions minimizing the ambiguity and the minimal dimensions of the ambiguity region are determined analytically, where the analytical expressions for the cross ambiguity function take into account the radar dimensions of the target along the dopler frequency and delay axes. These expressions are a generalization of the well known expressions for a point target. In contrast to the point target case, the width of the ambiguity region along the indicated axes cannot be made as small as desired and expressions are given for this lower limit. Figures 3; references: 5 Russian.

USSR

UDC 621.396.96:621.391.26

THE SYNTHESIS OF A SINGLE PULSE DISCRIMINATOR FOR A LOCATED TARGET

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24, No 4, Apr 79
pp 852-854 manuscript received 29 Mar 77

KUZ', N. YA.

[Abstract] The angular resolving power of a monopulse radar can be improved through the use of angular gating which makes it possible to sensitize the tracking system when several targets are present in the target area or flicker jamming is used. The information on the located target composition needed to control the gating unit can be obtained as described in US Patent No 3130402 where two receivers and two transmitters are used to find the

power contrast of the targets. Besides complexity, this system has the drawback of low efficiency when working in a passive mode with radiation sources. A statistically based approach to a solution of the same problem is proposed which employs two antennas and a receiver system consisting of linear filters which feed a subtracter, where a multiplier is inserted in one channel between the linear filter and the subtracter, and the subtracter in turn drives a squarer and an integrator. It is shown how this system can distinguish between group and single targets based on statistical decision making theory. Figures 2; references 4: 3 Russian, 1 Western.

USSR

UDC 621.396.96:621.391.26

POWER RATIO OF FLUCTUATING SIGNALS AND ITS USE IN THRESHOLD EVALUATION OF THE DEGREE OF DANGER OF AN INTERFERING SIGNAL FOR TRACKING RADAR SYSTEMS

Moscow RADIOTEKHNIKA in Russian Vol 34, No 5, May 79 pp 59-62

DEMENT'YEV, O. I. and MELEZHIK, V. A.

[Abstract] An examination is made of the problem of evaluating the action of a waveform consisting of the sum of a signal and interference on the input of tracking radar systems. A formula is derived for the probability of a situation where the signal-to-noise ratio will be less than some given threshold value. Tables are given that summarize the probability functions for all possible combinations of distributions of the interfering and useful signal powers by Rayleigh, exponential and uniform laws, and also when they are constant in time. These relations can be used for threshold evaluation of the degree of danger of an interfering signal that is similar in structure to the useful signal for tracking radar systems. Tables 4.

SEQUENTIAL DETECTION OF SIGNALS AGAINST A BACKGROUND OF UNSTEADY NORMAL INTERFERENCE

Moscow RADIOTEKHNIKA in Russian Vol 34, No 5, May 79 pp 70-73 manuscript received after completion 20 Nov 78

SHLOMA, A. M. and GOL'FEL'D, G. B.

[Abstract] An examination is made of the feasibility of using Student's t^2 statistic to synthesize a multichannel sequential detector for operation against a background of normal unsteady interference with an unknown intensity. It is assumed that the detector consists of a number of independent identical channels, and that independent sampling takes place at given instants. The procedure for verification of hypotheses used for constructing the multichannel unbiased invariant estimates is Wald's sequential probability ratio criterion. Block diagrams are given of multichannel sequential detectors that realize the proposed procedures in the case of cw and pulsed radar signals. Figures 2; references 3: 2 Russian, 1 Western.

USSR

UDC 621.396.666

INVESTIGATION OF STABILITY OF A SELECTIVE AGC SYSTEM

Moscow RADIOTEKHNIKA in Russian Vol 34, No 5, May 79 pp 54-55 manuscript received 1 Jun 78

YANIN, L. G.

[Abstract] An investigation is made of the stability of a continuous AGC system in a radio receiver of phase-keyed signals. In these devices, a radio signal after appropriate treatment is converted to a video signal where harmonic components are present with frequency $\omega_0 = 2\pi/\tau$, where τ is the duration of an elementary symbol. This component is then isolated by a bandpass filter and sent to the AGC detector. The constant component at the output goes through a low-frequency filter to the gain control circuit of the receiver. The initial models for the analysis are nonselective AGC systems of first and second orders that contain an amplitude detector and low-frequency RC filters in the feedback circuit. An investigation is made of the way that the stability of such systems is influenced by connecting a narrow bandpass filter with given time constant before the amplitude detectors. It is found that this increases the order of the differential equation of the AGC system by one. A second-order selective AGC system should be used for a receiver of phase-keyed signals. In this case the time constant of the narrow bandpass filter has a negligible effect on the stability of the system. References: 4 Russian.

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